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UNITED STATES TARIFF COMMISSION
WASHINGTON

TARIFF INFORMATION SURVEYS

ON THE ARTICLES IN

PARAGRAPH 151 OF THE TARIFF ACT OF 1913

AND RELATED ARTICLES IN OTHER PARAGRAPHS

BUCKLES OF IRON OR STEEL; SNAP FASTENERS; HOOKS AND EYES; METAL BUTTONS

Paragraph 151:
Buckles of Iron or Steel

Paragraph 151:
Snap Fasteners

Paragraph 151:
Hooks and Eyes

Paragraph 151:
Metal Buttons. (See Par. 339)

REVISED EDITION

WASHINGTON
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UNITED STATES TARIFF COMMISSION.

Office: Eighth and E Streets NW., Washington, D. C.

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PREFACE.

This is one of a series of tariff information surveys prepared by the United States Tariff Commission and transmitted to the Committee on Ways and Means. The series covers all of the articles and commodities provided for in the tariff act of October 3, 1913, and others not specifically provided for. It is arranged in the numerical order of paragraphs of that act.

In some cases two or more paragraphs have been combined in one pamphlet. In doing this, industrial relationship of the articles has been followed when possible. In those instances where a paragraph has been treated under a preceding paragraph of the tariff act, reference is made to this fact at the point where the paragraph appears in numerical order. Where one grade of an article is dutiable and another grade of the same article is on the free list, the article is discussed under the dutiable paragraph, which appears first in numerical order in the tariff act. In certain instances articles of close industrial relationship and which occur in separate paragraphs of the tariff act have been combined under one paragraph for convenience of discussion. Reference is made to this fact at the point where the commodities would naturally occur in numerical order.

The first pamphlet in the series is an "Introduction and index," which contains:

1. An introductory chapter discussing the scope of the series and the general method of treatment.
2. An alphabetical index of the articles provided for in the tariff act of 1913, showing the paragraph of the act in which the article is provided for and, if discussed under a different paragraph, the number of such paragraph.
3. A list of the pamphlets in the series, showing the paragraphs and articles included in each pamphlet.

Thus by use of this "Introduction and index," the exact location of the discussion relating to a given article or commodity can be ascertained.

In the preparation of this report the Tariff Commission had the services of H. J. Bierman, of the Metals Division of the commission's staff, and of others.

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METAL BUTTONS.

(See paragraph 339.)

BELT, TROUSERS, AND WAISTCOAT BUCKLES.

SUMMARY.

The manufacture of belt, trousers, and waistcoat buckles in the United States is not an industry in itself, but is carried on largely in conjunction with the manufacture of other kinds of hardware trimmings for wearing apparel, such as snap fasteners, buttons, clasps, slides, metal trimmings for suspenders and garters, etc.

There are between 10 and 15 concerns in the United States engaged in the manufacture of belt buckles. Practically the entire output of trousers and waistcoat buckles is made by two concerns, about 90 per cent being the output of one firm. There are several factories in Germany, and the industry of that country is much larger than it is in this country.

The domestic manufacture of belt, trousers, and waistcoat buckles is conducted chiefly in Connecticut, Maryland, and New Jersey, the combined annual output being estimated at about $500,000.

Of the various types and styles of buckles coming under the provisions of paragraph 151 only one type, the wire-prong buckle, has thus far been imported in considerable quantities. This buckle is used exclusively on trousers and waistcoats (vests), and for it there is no satisfactory substitute.

Foreign competition has come chiefly from Germany; Austrian and French buckles have been sold in the United States only to a small extent. German manufacturers invariably quote wire-prong buckles in this country at prices below those at which a similar American product is ordinarily sold.

Buckles of iron or steel—summary table.

Fiscal year.	Imports for consumption.		Amount of duty.	Value per unit of quantity.	Actual or equivalent ad valorem rate.
	Quantity.	Value.			
	Hundreds.				*Per cent.*
1910	9,058	$9,216	$4,390	$0.067	47.63
1911	38,761	6,077	2,975	.157	48.96
1912	39,062	6,238	3,037	.160	48.69
1913	44,566	6,942	3,402	.156	49.01
1914	[1] 8,341	11,934	2,219	.....	18 59
1915	.....	7,852	1,177	.....	15.00
1916	.....	715	107	.....	15.00
1917	.....	911	136	.....	15.09
1918	.....	316	47	.....	15.00
	Gross.				
1919	1,518	1,837	276	1.210	15.00
1920	11,866	20,194	3,022	1.702	15.00
1921 [2]	1,367	854	128	.620	15.00

[1] July 1 to Oct. 3, 1913, under act of 1909. [2] Calendar year.

Domestic production estimated in 1920 at approximately $500,000 annually, by H. Kerngood, Alma Manufacturing Co., Baltimore, Md.

General Information.

ACT OF 1913.

PAR. 151. Belt buckles, trousers buckles, waistcoat buckles, * * * made wholly or in chief value of iron or steel; * * * and parts thereof, not otherwise specially provided for in this section, 15 per centum ad valorem.

DESCRIPTION.

The buckles referred to in the above paragraph are made of iron or steel wire or sheet steel, or a combination of these two materials, japanned, nickeled, bronzed, or otherwise coated or plated, or polished.

Belt buckles on the American market are chiefly of three kinds: Heel tongue, sliding tongue, and rolling bar.

Heel-tongue buckles are made of steel wire, welded or dovetailed, with either steel or brass wire tongues. The usual sizes range from ⅝ inch to 1¼ inches. Besides their use on wearing apparel, belt buckles find use also on abdominal supporters, surgical appliances, and leather goods, such as belts, overgaiters, traveling bags, shoes, sandals, and many other articles.

Sliding-tongue buckles are made of sheet steel, with a sliding tongue which forces the strap against the end bar of the frame, where it is held under tension. These buckles are used exclusively on belts. The size is commonly 1 inch.

Rolling-bar buckles are made of sheet steel, with a prong clamp by means of which the buckle is firmly attached to one end of the strap, and a rolling bar designed to hold the loose end of the strap at the required tension when in use. This style is more elaborately made than any of the other belt buckles coming under the provisions of paragraph 151, and they command much higher prices.

Trousers and waistcoat buckles are usually made with wire prongs or with teeth, although other styles, such as sliding bar and grip lock buckles, are also made to a limited extent.

Prong buckles are made of iron or steel wire or sheet steel, or a combination of both, in numerous designs, and each design in one or more sizes, ranging from 6-line to 12-line. The type of prong buckle made entirely of wire is the kind most largely used, and this is the only type of trousers and waistcoat buckle that has thus far been sold in the United States by foreign manufacturers.

Buckles with *teeth* instead of prongs, made entirely of sheet steel, were introduced by domestic manufacturers about 1914, chiefly to combat foreign competition.

DOMESTIC PRODUCTION.

Trousers and waistcoat buckles are manufactured in the United States annually to the extent of approximately $500,000, and chiefly by one concern [1] in Maryland.

Materials.—Steel wire and sheet steel are the principal raw materials entering directly into the finished product, though brass is also used to a limited extent. Japan, lacquer, copper, and acids

[1] Statement of H. Kerngood, Alma Manufacturing Co., Baltimore, Md.

and plating materials are used in considerable quantities in the process of finishing. Emery or similar material is used in grinding and lime is used in polishing. All of these materials are produced in the United States. Prior to the war Vienna lime, imported from Germany, was used exclusively, because of its superiority. When the supply of Vienna lime was cut off, American hydrated lime was substituted.

Machinery.—Automatic and semiautomatic machines are used in making the buckles up to the finishing point; thereafter much hand labor is required. The machines used are of German origin, but they have been improved by the manufacturer in his own factory.

Labor.—Approximately 1,000 persons are said to be employed in the domestic industry, about 80 per cent of whom are males. A few boys and girls under 16 years of age are employed in the industry, but it is stated that their services are not satisfactory and their employment is not encouraged. Female labor is employed chiefly in the packing department. Approximately 50 per cent of the hand-work on trousers and waistcoat buckles is done in the homes of workers, who are engaged exclusively in assembling parts.

Practically all of the skilled workers are males and are employed in the tool room and finishing departments. Skilled labor represents approximately 30 to 35 per cent of the total labor employed.

Wages paid increased greatly during and after the war. Thus the weekly rates of skilled workers (toolmakers, male) were about 100 per cent higher in 1920 than in 1914; of unskilled male workers, from 90 to 100 per cent; and of unskilled female workers, from 50 to over 100 per cent. Furthermore, the reduction in hours per week, from 56 in 1914 to 53 in 1920 and to 49½ in 1921, resulted in a still larger percentage of increase when computed on an hourly basis.

The average wages paid to workers over 16 years of age in one pre-war and one post-war year are given in the following table, which shows that average wages in the industry in 1920 increased from 58 to 120 per cent over the average paid in 1914:

Class of worker.	Average wages paid per hour.[1]		Average increase per hour (1920 over 1914).
	1914	1920	
			Per cent.
Skilled (toolmakers) male	$0.36–$0.71	$0.57–$1.13	59
Unskilled male	.18– .32	.38– .66	111–105
Unskilled female	.14– .21	.23– .47	58–120

[1] Computed from information furnished by H. Kerngood, Alma Manufacturing Co., Baltimore, Md.

Early in 1921, business depression in the industry led to a half-time schedule in the factory of the Alma Manufacturing Co., which produces the bulk of the domestic output of trousers and waistcoat buckles. The mills were shut down three days out of each week as an alternative to a reduction in wages.

Organization.—The manufacture of trousers and waistcoat buckles in the United States is carried on in connection with the manufacture of buttons, snap fasteners, clasps, and similar articles. The minimum capital required for the efficient conduct of the industry is estimated

as about 100 per cent of the annual output, approximately 60 per cent of which would represent buildings and machinery, 20 per cent material, and 20 per cent current capital.[2]

The industry is located chiefly in Baltimore, Md., where approximately 90 per cent of the total domestic product is made.[2] The remaining 10 per cent is distributed among 10 or 15 manufacturers in the States of New Jersey and Connecticut.

Domestic production and consumption.—In normal times production in the United States amounts to approximately $500,000 annually,[2] and supplies the bulk of the domestic consumption. American manufacturers are amply equipped to meet any demands that are likely to be made upon the industry.

Exports.—Statistics of exports are not available.

FOREIGN PRODUCTION.

Prior to the World War, Germany, Austria, and France were the principal foreign producing countries, ranking in importance in about the order named. Foreign-made buckles are equal in quality to those made in America, and before the war sold in this country at lower prices.

IMPORTS.

So far as known, imports under paragraph 151 in the past have been confined wholly to trousers and waistcoat buckles of only one type, the wire-prong buckle.

Prior to 1914 wire-prong buckles were imported from Germany, Austria, and France. Shortly after the outbreak of hostilities in Europe imports are reported to have ceased entirely, and up to 1921 they had not attained their former volume.

Statistics of imports published by the Department of Commerce undoubtedly include buckles, or articles of other kinds than the buckles mentioned in paragraph 151. This is evinced by the high average prices per unit of quantity (especially since 1919), which are out of proportion to the true value of these articles. Thus in 1920 the average price of domestic buckles ranged from about $0.55 to $1.30 per gross, whereas the average value per gross computed for imports in 1919 is $1.74, and in 1920 $2.45, when in fact the prices quoted on the American market for foreign buckles were lower than the domestic prices.

The official figures for imports of trousers and waistcoat buckles valued at not more than 50 cents per hundred for the fiscal years 1908 to 1913 indicate with a greater degree of accuracy the true import movement before the war. These figures show that from 24,649,100 buckles imported in the fiscal year 1908 the quantities decreased annually to 3,905,200 in 1912. In 1913 the imports increased to 4,454,200 buckles.

In 1913 an American importer stated before the Committee on Ways and Means of the House of Representatives that buckles valued at over 50 cents per hundred were not being imported.[3]

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[2] Statement of H. Kerngood, Alma Manufacturing Co., Baltimore, Md.
[3] H. R. Doc. No. 1447, p. 5082.

TARIFF HISTORY.

Under the tariff act of 1894 buckles covered by this survey were dutiable as manufactures of metal at 35 per cent ad valorem.

Beginning with 1897 trousers buckles, made wholly or in part of iron or steel, and parts thereof, were separately provided for at compound duties, the specific rates varying from 5 to 15 cents per 100, according to the value, and the ad valorem rate at 15 per cent.

The act of 1909 continued these rates and applied them also to waistcoat buckles.

The act of 1913 enlarged the provision to include belt buckles, all to bear 15 per cent ad valorem when made wholly or in chief value of iron or steel and not otherwise specially provided for.

During the operation of the act of 1897 imports increased somewhat, and though the rates of duty had not changed the amounts decreased greatly during the period covered by the act of 1909. After the act of 1913 became operative imports began to increase. They were, however, soon afterwards curtailed by the outbreak of war in the principal foreign producing countries. After the war had ceased imports began to recover rapidly, and indications are that while the quantity will be smaller the value will exceed that of imports during any of the preceding years.

COMPETITIVE CONDITIONS.

In 1921 sales of foreign-made belt, trousers, and waistcoat buckles in the United States were small. Prior to the war, German trousers and waistcoat buckles were sold in this country at prices considerably lower than similar buckles of domestic manufacture. Competition appears to have been keenly felt during the period from the passage of the act of 1913 to the time communication with Germany was cut off by reason of the war. American manufacturers state that after the rate of duty was reduced by the act of 1913 German buckles were offered to the American trade below the cost of their manufacture in this country, and that the advent of the war prevented heavy losses in domestic trade.

After the war German manufacturers again bid for the American trade by offering prong trousers and waistcoat buckles at $2.70 per thousand, delivered to the United States, of a grade quoted by American manufacturers at $5.20, and said to cost them $4.69 per thousand to produce.

The process employed in the manufacture of buckles in Germany and in the United States is practically the same. No appreciable differences are reported between the cost of raw materials in the two countries. The value of raw materials used in the manufacture of prong buckles amounts to only about one-sixth of the total cost of the finished article, whereas labor amounts to fully one-half of the total cost. It is asserted that the German manufacturers have a decided advantage over the American by reason of their lower wage rates.

STATISTICAL MATERIAL.

Imports for consumption—Revenue.

TROUSERS AND WAISTCOAT [1] BUCKLES, OR PARTS OF, MADE WHOLLY OR PARTLY OF IRON OR STEEL.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
			VALUED AT NOT MORE THAN 15 CENTS PER HUNDRED.			
		Hundreds.				*Per cent.*
1908	5 cents per 100 plus 15 per cent.	244,344	$18,508	$14,993	$0.076	81.01
1909	do	71,594	7,589	4,718	.106	62.17
1910	do	58,097	8,801	4,225	.151	48.00
1911	do	36,460	5,356	2,626	.147	49.04
1912	do	36,087	5,399	2,614	.150	48.42
1913	do	41,927	6,281	3,038	.149	48.37
1914 [2]	do	8,081	1,211	585	.150	48.37
			VALUED AT MORE THAN 15 CENTS AND NOT MORE THAN 50 CENTS PER HUNDRED.			
1908	10 cents per 100 plus 15 per cent.	2,147	$643	$311	$0.299	48.39
1909	do	6,872	1,238	872	.180	70.51
1910	do	810	236	116	.291	49.32
1911	do	2,079	495	282	.238	57.00
1912	do	2,965	821	419	.277	51.11
1913	do	2,615	597	351	.228	58.80
1914 [2]	do	260	82	38	.315	46.71
			VALUED AT MORE THAN 50 CENTS PER HUNDRED.			
						Per cent.
1908	15 cents per 100 plus 15 per cent.	158	$153	$46	$0.965	30.54
1909	do	447	646	163	1.445	25.38
1910	do	151	179	49	1.185	27.65
1911	do	222	226	67	1.020	29.73
1912	do	10	18	4	1.800	23.33
1913	do	24	64	13	2.666	20.63

[1] Waistcoat buckles added by act of 1909. [2] July 1 to Oct. 3, 1913, under act of 1909.

BELT, TROUSERS, OR WAISTCOAT BUCKLES MADE WHOLLY OR PARTLY OF IRON OR STEEL—CONSUMPTION.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Gross.				*Per cent.*
1914 [3]	15 per cent		$10,641	$1,596		15
1915	do		7,852	1,177		15
1916	do		715	107		15
1917	do		911	136		15
1918	do		316	47		15
1919	do	1,518	1,837	276	1.210	15
1920	do	11,866	20,194	3,022	1.702	15
1921 [4]	do	1,367	854	128	.62	15

[3] Oct. 3, 1913, to June 30, 1914, under act of 1913. [4] Calendar year.

Buckles of iron or steel—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rate of duty.
1890	215	*Act of 1890, paragraph 215.*—Manufactures, articles, or wares, not specially enumerated or provided for in this act, composed wholly or in part iron, steel, * * * and whether partly or wholly manufactured.	45 per cent ad valorem.
1894	177	*Act of 1894, paragraph 177.*—Manufactured articles or wares, not specially provided in this act, composed wholly or in part of any metal, and whether partly or wholly manufactured.	35 per cent ad valorem.
1897	412	Trouser buckles made wholly or partly of iron or steel, or parts thereof, valued at not more than 15 cents per 100.	5 cents per 100.
		Valued at more than 15 cents per 100 and not more than 50 cents per 100.	10 cents per 100.
		Valued at more than 50 cents per 100	15 cents per 100.
		And in addition thereto, on each and all of the above buckles or parts of buckles.	15 per cent ad valorem.
1909	425	Trouser buckles and waistcoat buckles, made wholly or partly of iron or steel, or parts thereof, valued at not more than 15 cents per 100.	5 cents per 100.
		Valued at more than 15 cents per 100 and not more than 50 cents per 100.	10 cents per 100.
		Valued at more than 50 cents per 100	15 cents per 100.
		And in addition thereto on each and all of the above buckles or parts of buckles.	15 per cent ad valorem.
1913	151	Belt buckles, trouser buckles, waistcoat buckles, snap fasteners and clasps by whatever name known, any of the foregoing made wholly or in chief value of iron or steel; * * * all the foregoing and parts thereof, not otherwise specially provided for in this section.	Do.

Court and Treasury Decisions.

Buckles used on shoulder straps of overalls and which are of the character of suspender buckles were held dutiable as manufactures of metal and not as trousers' buckles under the act of 1897. (United States *v.* Topken, 115 Fed. 233.)

Belts of which metal buckles were the component material of chief value were held dutiable as manufactures of metal and not as articles of silk, under the act of 1897. The metal was adjudged not immaterial or incidental to the belts but an essential part in determining the tariff classification of the goods. (Simpson-Crawford Co. *v.* United States, 178 Fed. 1006, affirming 172 Fed. 310.)

Steel slides or buckles made of cut steel or other base metal, some ornamented with rhinestones and some colored in imitation of gold or silver, which are used on slippers as ornaments, were held not dutiable as jewelry but as manufactures of metal under the act of 1897. (Bailey *v.* United States, T. D. 26195, 26226.)

Note.—For decisions upon other buckles, see Tariff information surveys upon "Jewelry," etc.

SNAP FASTENERS.

SUMMARY.

Snap fasteners, referred to in paragraph 151 of the act of 1913, are of two distinct classes and types. Manufacturers of one class or type do not make the other. One class is used exclusively on garments, to which they are sewed. These are known as sew-on fasteners. When in use the sew-on fastener is invisible, because of its location between the over-lapping cloth. The other class finds use on a great variety of articles and is attached chiefly by means of riveting. The top of the rivet fastener is always exposed to view, and for that reason it is more or less highly finished in color, material, or design. This type is much more elaborate and in all respects a higher grade article than the sew-on type. It is made in a greater variety, and requires from four to five times the quantity of materials, and much more labor to manufacture. The cost of making sew-on fasteners is, therefore, much less than the cost of making rivet fasteners. Reports of manufacturers in 1921, gave 9 cents a gross as the cost of sew-on fasteners and from about 35 cents to several dollars a gross as the cost of rivet fasteners, the cost of the latter depending largely upon the kind and finish.

Rivet-on snap fasteners have been manufactured in the United States for many years, but it was not until shortly before the war that the manufacture of the sew-on type began to assume much importance. Rapidly increasing production was brought about by the introduction of an improved type made in this country by German or Austrian interests under a patent granted early in 1914 by the United States to Heinrich Waldes, a citizen of Austria-Hungary. The stoppage of imports from continental Europe during the war greatly stimulated the domestic manufacture of this type of fastener, and in a very short time many new American concerns were making sew-on fasteners similar to those made under the patent of 1914.

Early in 1921, 24 concerns were reported to be engaged in the manufacture of sew-on fasteners, with an aggregate annual output in excess of 1,500,000 great gross (18,000,000 gross). The American capital invested in the industry was said to amount to over $5,000,000 and the number of persons employed, to approximately 2,000. The domestic output of rivet fasteners is reported to be approximately 3,000,000 gross annually, made by about 15 establishments. The total capital required in the manufacture of rivet fasteners is relatively much larger than that required for the production of sew-on fasteners.

Before the war snap fasteners were produced in Germany, Austria-Hungary, France, England, and Italy. Germany and the dual monarchy were at that time the world's largest producers and their products were sold in practically all of the important world markets. The stoppage of supplies from these two countries during the

war stimulated the industry in some of the other countries—notably the United States, Brazil, and Japan—and while efforts will no doubt be made by Germany, and possibly Austria, to regain their former markets the reëstablishment of the supremacy formerly held by them in the snap-fastener industry is, at this writing, still problematical.

Prior to 1909 snap fasteners were not enumerated in the tariff or specified in official American import statistics. The act of 1909 imposed a duty of 50 per cent ad valorem on snap fasteners and clasps of all kinds. The act of 1913 reduced the rate on snap fasteners of iron or steel to 15 per cent ad valorem and on snap fasteners of brass to 20 per cent ad valorem.

Imports, as specified in reports of the Department of Commerce, have not been large but manufacturers allege that actual imports have been greater than these reports indicate.

Snap fasteners of iron and steel and of brass—Summary table.

Fiscal year.	Domestic production.	Ratio of imports to production.	Imports for consumption.	Amount of duty.	Equivalent ad valorem rate.
	Value.	*Per cent.*	*Value.*		*Per cent.*
1910			$11,064	$5,532	50.00
1911			19,251	9,625	50.00
1912			38,564	19,282	50.00
1913			90,292	45,146	50.00
1914	714,492	18.21	130,077	35,391	27.21
1915			18,994	2,849	15.00
1916			15,872	3,059	19.28
1917			34,315	5,928	17.28
1918			4,112	702	17.08
1919	7,438,551	.03	1,998	299	15.00
1920			22,050	3,439	15.59
1921[1]			75,515	14,704	19.47

[1] Calendar year.

GENERAL INFORMATION.

PAR. 151. * * * Snap fasteners * * * made wholly or in chief value of iron or steel * * * 15 per centum ad valorem.

PAR. 167. Articles or wares not specially provided for in this section, * * * if composed wholly or in chief value of * * * brass * * * 20 per centum ad valorem.

DESCRIPTION.

All snap fasteners consist of two members, known as "stud" and "socket," and are divided into two distinct classes:

Sew-on fasteners.—These are made exclusively for use on women's garments, the name "sew on" being derived from the manner of attaching the fastener to the garment. When attached to a garment the sew-on fastener is invisible because of its position between the overlapping cloth; an ornamental or particularly high finish is therefore not required for this type of fastener.

Rivet fasteners.—This class is made to attach to an almost endless variety of articles, such as gloves, pocketbooks and other leather goods, umbrellas, caps, belts, advertising novelties, suspenders, garments, carriage tops, tire covers, automobiles, tents, etc., by means of riveting with suitable dies and machines, or by means of screws or nails. Unlike the "sew-on" fastener, the "rivet" fastener

when attached to an article, has the top exposed to view. In order, therefore, to make the appearance of the article neat or attractive the top is finished in design or color to conform to the material or article upon which the fastener is to be used.

Snap fasteners are used as a substitute for buttons, hooks and eyes, or buckles and, because of their convenience in fastening and releasing articles temporarily held together, they are increasing in public favor.

DOMESTIC PRODUCTION.

In 1914 the United States Bureau of the Census reported the production of 91,957 great gross of "snap fasteners and clasps, or parts of," valued at $174,492.

According to the brief of Mr. Samuel Blumberg, of New York, representing the Snap Manufacturers' Association of America, filed at the hearings before the Committee on Ways and Means, House of Representatives, in January, 1921, the total domestic production of snap fasteners (of the "sew-on" type) at the present time is over 1,500,000 great gross (18,000,000 gross) annually; the total number of producing companies, 24; the number of persons employed, approximately 2,000, and the total capital invested in the industry, over $5,000,000.

The total annual production of the "rivet-on" type of fasteners in this country is estimated by manufacturers[1] to be approximately 3,000,000 gross annually, produced by about 15 concerns.

Materials.—Of the materials employed, strip brass is used in by far the largest quantity. Sheet steel, tin, and zinc are used to only a limited extent. Phosphor bronze wire is used almost exclusively for springs in the "sew-on" type of fastener, whereas in certain kinds of the "rivet-on" type only steel wire is employed. In the "rivet-on" type the finishing materials are enamels, celluloid, cloth, leather, leatherette, mother-of-pearl, horn, and plain and plated metal, whereas in the "sew-on" type, only japan, and tin and nickel for plating are used. In preparing the "sew-on" type for market, the fasteners are attached to cards while "rivet-on" fasteners are packed loose in boxes. With the exception of some of the finishing materials, the raw products used are of domestic origin.

Equipment.—In establishments making the sew-on type of snap fasteners the equipment consists almost wholly of power-driven automatic machines. Automatic machines are also employed to a large extent in the manufacture of the "rivet-on" type, but many of the later operations are performed on hand and foot presses. Other equipment consists chiefly of tools and dies for cutting, forming, stamping for ornamentation, closing and assembling, and outfits for polishing, plating, and lacquering.

Methods of production.—"Sew-on" snap fasteners are produced in the United States by power-driven automatic machines. Sheet brass in strips of the proper width and thickness is automatically fed into a power-driven automatic machine, and after being subjected to more than a dozen operations, is ejected in the form of tops of snap fasteners, complete, except for plating

[1] Messrs. H. Kerngood of the Alma Manufacturing Co., Baltimore, Md., and Geo. W. Traut, of Traut & Hine Manufacturing Co., New Britain, Conn.

or finishing. The other part—the bottom—of the snap fastener is made on a similar machine. By a recent innovation the operations involved in making the top are divided between two machines. The first stamps the part up to a certain point, forms the socket and punches the holes; the second cuts the blank from the metal strip, finishes the shaping of the socket, and inserts the spring. With machines of this type greater speed in production can be obtained. Recently a machine was perfected for attaching the snap fasteners automatically on cards, work which has generally been performed by women and children.

A set of three machines turns out snap fasteners at the rate of about 100 per minute. The carding machine will card 80 great gross per day.

Rivet snap fasteners, being much more elaborate in construction and appearance than sew-on fasteners, require greater care in manufacturing. The sew-on fastener consists of but three parts, whereas rivet-on fasteners are composed of from four to nine parts, according to the kind. Since the rivet-on fasteners are used on materials of various thicknesses, the height of socket and eyelet must be made to vary according to the material through which they pass to unite with the top or stud. On this account and because the top must be made to harmonize with the color or kind of material on which the fastener is to be used, or to conform in style or finish to the desire of the purchaser, the manufacture of this type is complicated, and the output, to a certain extent, dependent upon the specifications or particular requirements of customers.

Automatic machines are used in the process of blanking and forming, but these operations constitute only a very small percentage of the total labor cost required to make the finished article. Assembling, stamping, covering, finishing, assorting and packing are all done by hand, and represent the larger part of the labor cost.

Organization.—In the manufacture of the "rivet-on" type of snap fastener, the industry is conducted to best advantage in large establishments, because the various operations can be more economically coordinated. To conduct the business successfully, it is said that there should be a capital investment of at least $50,000. Some of the large plants in operation in 1921 have an investment amounting to as much as $2,000,000.[2] In this industry the successful conduct of the business necessitates carrying a large stock of materials, because lack of a size or gauge of metal, or color and size of celluloid is likely to cause serious delay in the delivery of a customer's order.

In 1921 there were about 15 establishments in the United States engaged in the manufacture of the rivet-on type of snap fastener, located in the northeastern section of the country. The total annual output amounted to approximately 3,000,000 gross, about two thirds of which was produced by three concerns.

The total capital invested by the 24 concerns engaged in the production of snap fasteners of the sew-on type in the United States in 1921 is reported to be over $5,000,000.[3]

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[2] Brief of Mr. Samuel Blumberg, of New York City, filed with the Committee on Ways and Means, House of Representatives, on Jan. 14, 1921.

[3] About 90 per cent of the total annual output is produced by 12 concerns.

Geographical distribution.—Plants for the manufacture of sew-on snap fasteners are located in Connecticut, New York, Ohio, Illinois, New Jersey, Massachusetts, and several other States. Rivet fasteners are produced in Connecticut, Massachusetts, Rhode Island, New York, New Jersey, and Maryland.

History of the industry.—Snap fasteners of the rivet-on type have been manufactured in the United States since about 1895, and are now (1921) produced by about 15 establishments.

In January, 1914, Heinrich Waldes, a citizen of Austria-Hungary obtained a patent in the United States on a snap fastener with a reinforcing wire spring in the socket. This type used exclusively on garments has become known as the "sew-on" fastener from the fact that it is fastened to the garment by means of sewing. Other styles of the sew-on fastener soon afterwards appeared on the market, and the domestic industry, aided by the stoppage of importation from continental Europe after the outbreak of the war, grew rapidly until early in 1921 when there were reported to be 24 concerns engaged in the manufacture of this type alone.

Domestic production and consumption.—In normal times practically all the snap fasteners produced in the United States are consumed in this country. The producing capacity of domestic establishments is amply sufficient to meet any demands that are likely to be made upon the industry.

Domestic exports.—Ordinarily very few snap fasteners are exported from the United States. During the war, when exportation from continental Europe stopped, some of the domestic product was sold in Canada, Mexico, England, Australasia, and South American countries. Exports ceased shortly after the close of the war, because of the rapidly decreasing value of foreign moneys in terms of United States currency.

An obstacle to the exportation of rivet fasteners, which does not exist in the case of the sew-on fasteners, is the requirement that they be made to conform in color, style, and length of shank to the kind and thickness of material on which they are to be used.

FOREIGN PRODUCTION.

Before the war Austria and Germany were the leading producers, both countries manufacturing snap fasteners with the reinforcing spring, a type not then made in the United States. The leading firm in Germany was the William Prym Co., and the leading firm in Austria was Waldes & Co. The Austrian firm of Waldes & Co., of Prague-Wrschwitz, began the production of Kohinoor snap fasteners in 1913, using automatic machines, the mechanism of which was a carefully guarded secret. The factory was organized on a large scale, having 375 machines operated by 700 persons—men and women—and employing hundreds of home workers to attach the fasteners to cards. A snap fastener similar to the Austrian type was produced in Germany before the industry was established in Austria.

In Japan the industry has developed since 1915, when supplies of snap fasteners for the Far East from Germany and Austria were cut off. In 1917 about 70 per cent of the Japanese output was produced in factories; the remainder in households. Some power-driven machines were used in the factories for rounding the knobs and cutting

the small openings through which the springs operate. For most operations in the Japanese factories the managers found hand machines quicker and more economical in the use of material than power machines. All the work except the heavy work or that requiring technical skill was performed by women and children. Home workers were employed to place the snap fasteners on cards and to do the packing.[4]

In Brazil two well-equipped snap fastener factories succeeded in stocking the market in the latter part of 1917, and practically eliminated foreign competition.

Foreign rivet-on fasteners are produced chiefly by Germany, Austria, France, England, and Italy.

IMPORTS.

The quantity of snap fasteners imported is not specified in Commerce and Navigation, and statistics for value of imports are not altogether satisfactory.

From 1910 to October 3, 1913, imports of snap fasteners were specified under the classification of "snap fasteners or clasps or parts of" and apparently included snap fasteners of all kinds, of iron and steel as well as of brass. From October 4, 1913, to June 30, 1915, only snap fasteners and clasps of iron and steel were specified. Snap fasteners of brass, if any were imported, were apparently classed as manufactures of brass. Beginning with the fiscal year 1916, snap fasteners of iron or steel and of brass have been specified. In 1910 the value of imports was $11,064. The value of imports increased steadily during the next few years, reaching $90,292 in 1913 and $130,078 in 1914. Then came a sharp drop to $18,994 in 1915, a further slight decline in 1916, a recovery to $34,315 in 1917, another drop to $4,112 in 1918, and to $1,998 in 1919. A rise to $22,050 is shown in 1920. During the fiscal year 1920 snap fasteners were imported from Germany, Sweden, and Switzerland. Exact statistics for the year are not yet available, but the quantity imported was not large. Most of the snap fasteners imported recently were made of brass and came from Germany. With the exception of some imported from Prym & Co., in Germany, the snap fasteners imported in 1920 were of inferior quality. Importers were compelled to sell at a loss some snap fasteners from Sweden and Switzerland.

One shipment of 3,000 great gross of snap fasteners from Switzerland was held dutiable at 50 per cent as manufactures of metal, silver plated, whereas the importer had expected to pay only 20 per cent.

PRICES.

Sew-on fasteners are attached to cards, usually 1 dozen to a card, sold to jobbers and wholesalers, and distributed to the consuming public by retailers.

The retail price of snap fasteners is 5 to 10 cents a card (usually 12). The wholesale price of the spring-reinforced snap fastener was reported to be $2.50 to $8.10 per great gross in 1919, averaging about $4. In 1917 two Japanese manufacturers estimated their costs

[4] The foregoing information on the Japanese industry is from Commerce Reports No. 69, Mar. 24, 1917.

at $24.33 per 100 gross, or $2.92 per great gross. This included overhead charges as well as cost of labor and materials. The wholesale price quoted by manufacturers in Brazil in January, 1918, was 18 milreis per great gross, equivalent to $4.86 at the rate of exchange then existing. American snap fasteners at that date were quoted to Brazilian importers at $4.25; adding to this the cost of freight, customs, brokers' charges, etc., brought the total cost up to $4.90.

On account of fluctuating exchanges and generally abnormal conditions it is impossible to make any satisfactory comparisons between domestic and foreign prices in 1920. Early in 1920 some snap fasteners of brass, japanned, and with rounded edges on the bottom, and reinforcing spring—that is to say, fasteners of good quality—were imported from Germany at 4½ marks per gross. If the purchaser paid for those with marks at 2 cents the cost was equivalent to $1.08 per great gross. According to officials at the appraisers warehouse in New York, inferior snap fasteners from Sweden and Germany were imported at from 5 to 8 cents per gross, or 60 to 96 cents per great gross.

A New York wholesale dealer in notions asserted in May, 1920, that American snap fasteners on cards could then be bought at $2.25 per great gross, and that this was less than the price at which they could be imported from Germany. This dealer said that before the war the ordinary price of German snap fasteners was 28 to 30 pfennig per gross, or 80 to 86 cents per great gross, but that at one time during a price war between Prym's, in Germany, and Waldes & Co., in Austria, the price was as low as 40 cents per great gross.

The demand for snap fasteners of the rivet-on type comes entirely from manufacturers of articles on which the fastener is used, because it is not practicable for the ultimate consumer to buy these fasteners for use on an individual article, as a machine is required to attach the fastener to the article.

Rivet-on fasteners are made in great variety of style, size, color, finish, and tension, and the prices at which sold, therefore, vary greatly. In 1921 prices of rivet-on snap fasteners, as quoted by a leading domestic manufacturer, ranged from $0.38½ to $9.50 a gross.

TARIFF HISTORY.

Prior to 1909 snap fasteners and clasps were not mentioned in the tariff or specified in Commerce and Navigation. The act of 1909 imposed a duty of 50 per cent ad valorem on snap fasteners or clasps, or parts thereof, by whatever name known. Under this act imports increased from $11,064 in 1910 to $90,292 in 1913 and to $45,370 during the first three months of the fiscal year 1914. The act of 1913 reduced the duty on snap fasteners of iron or steel to 15 per cent ad valorem and on snap fasteners of brass [5] to 20 per cent ad valorem. The effects of this marked reduction were obscured by the war, which disrupted the industry in the chief producing countries—Germany and Austria. These countries in March, 1915, placed export and transit embargoes on snap fasteners. Imports of snap fasteners of iron or steel during the last nine months of the fiscal year 1914, when the new law was in effect, were valued at $84,708. In 1915 they fell to

[5] As manufactures of brass not specially provided for, par 167.

$18,994 and in 1916 to $2,299. Imports rose again to $18,689 in 1917 and fell to $2,403 in 1918. Imports of snap fasteners of brass were not specified prior to 1916. In that year they were valued at only $13,573 and in 1918 at $1,709.

COMPETITIVE CONDITIONS.

In the manufacture of snap fasteners, automatic machinery is employed in the United States to a somewhat greater extent than it is in foreign countries, and, while there is normally little difference in the prices of raw materials in the various countries, adequate supplies of domestic origin are obtained in this country, whereas the foreign-producing countries must import their strip brass or the copper from which it is made. In European countries, however, lower rates of wages are paid. Normally average wages in England are somewhat higher than those paid on the Continent, but lower than those paid in this country.

The difficulty of supplying a customer with the kinds of rivet fasteners required for his particular needs forms an obstacle in overseas trade that must be met. These fasteners must not only be of color, size, and shape to harmonize with the material on which used, but, since the fasteners are used on materials of various thicknesses, the height of socket and eyelet must vary according to the material through which they pass to unite with the top or stud. In order that parts of correct height may be furnished, it is necessary to specify the exact thickness of the material.

It is stated by American producers that before the war German manufacturers largely overcame this obstacle by carrying stocks of rivet fasteners of standard kinds in this country from which orders could be filled promptly; and furthermore, that it was not an uncommon occurrence for a customer to order from a domestic manufacturer a small quantity of rivet fasteners to last until a larger supply could be obtained from a foreign country at lower prices, some of the domestic fasteners being used as samples or models to guide the foreign manufacturer in filling the order.

TARIFF CONSIDERATIONS.

It was alleged in tariff hearings in 1913, by S. Basch & Co., of New York City, representing Waldes & Co., of Austria, that the rate of duty then existing on snap fasteners (50 per cent) was almost prohibitive; that no snap fasteners with a wire spring were manufactured in this country; and that therefore the imported article did not compete with any American product. On the other hand, the brief of the American manufacturers of snap fasteners stated that the United States Fastener Co. had made for more than 10 years "sew-on" fasteners which entered into direct competition with the imported article. This brief states further that the foreign article, after paying the 50 per cent duty, was sold here at a price less than American factory costs. It was also asserted in this brief that snap fasteners had been imported under a variety of names, making it difficult to index the imports.

Mr. Simon Nager, jr., appearing before the Committee on Ways and Means, July 21, 1919, as the representative of the snap-fastener in-

dustry of the United States, stated that American producers feared German competition, the war being over. He was of the opinion that a 50 per cent duty would be required to meet the lower labor costs in Germany. German interests, he said, were then in New York prepared to reestablish themselves in this market. He doubted the correctness of the import statistics in Commerce and Navigation, as there was evidence that the importers' business had been much larger than official import statistics indicated. Three thousand great gross of snap fasteners imported from Switzerland in 1919 were appraised as manufactures of metal, silver plated, and held dutiable at 50 per cent ad valorem, instead of at 20 per cent, as the importer expected. The importer asserts that these fasteners were not silver plated in the real sense of the term, but only dipped in a silver solution to make them rust proof.

STATISTICAL MATERIAL.

Production in the United States.

SNAP FASTENERS AND CLASPS, OR PARTS OF.

[From "Federal Census."]

Year.	Quantity.	Value.
	Great gross.	
1914	91,957	$714,492
1919	2,122,541	[1] 7,438,551

[1] In addition snap fasteners to the value of $556,654 were made in establishments engaged primarily in the manufacture of other products.

Imports for consumption—Revenue.

SNAP FASTENERS OR CLASPS OR PARTS OF BY WHATEVER NAME KNOWN.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
						Per cent.
1910 [1]	50 per cent		$11,064	$5,532		50
1911	do		19,251	9,625		50
1912	do		38,564	19,282		50
1913	do		90,292	45,146		50
1914 [2]	do		45,370	22,685		50

SNAP FASTENERS OR CLASPS OR PARTS OF BY WHATEVER NAME KNOWN, OF IRON OR STEEL.

						Per cent.
1914 [3]	15 per cent		$34,707.65	$12,706.15		15
1915	do		18,994.00	2,849.10		15
1916	do		2,299.00	344.85		15
1917	do		18,689.00	2,803.35		15
1918	do		2,403.00	360.45		15
1919	do		1,997.00	299.55		15
1920	do		19,419.00	2,912.85		15
1921 [4]	do		7,957.00	1,193.00		15

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909; not specified prior to Aug. 6, 1909.
[2] July 1 to Oct. 3, 1913, under act of 1909.
[3] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[4] Calendar year.

Imports for consumption—Revenue—Continued.

SNAP FASTENERS OR CLASPS OR PARTS OF BY WHATEVER NAME KNOWN, OF BRASS.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
1916[1]	20 per cent		$13,573	$2,714		20
1917	do		15,626	3,125		20
1918	do		1,709	341		20
1919	do	100	1			20
1920	do		2,631	526		20
1921[2]	do		67,558	13,511		20

[1] Not specified prior to 1916. Apparently included in the figures for the years 1910–1914, and in 1915 under "other manufactures of brass."
[2] Calendar year.

Snap fasteners—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rate of duty.
1883	186	* * * all manufactures of copper, or of which copper shall be a component of chief value, not specially enumerated or provided for in this act.	35 per cent ad valorem.
1883	216	Manufactures, articles, or wares, not specially enumerated or provided for in this act, composed wholly or in part of iron, steel, copper * * * or any other metal.	45 per cent ad valorem.
1890	215	Manufactures, articles, or wares, not specially enumerated or provided for in this act, composed wholly or in part of iron, steel, * * * copper, * * * or any other metal.	Do.
1894	177	Manufactured articles or wares, not specially provided for in this act, composed wholly or in part of any metal.	35 per cent ad valorem.
1897	193	Articles or wares not specially provided for in this act, composed wholly or in part of iron, steel, * * * copper, * * * or other metal.	45 per cent ad valorem.
1909	427	* * * snap fasteners, or clasps, or parts thereof, by whatever name known.	50 per cent ad valorem.
1913	151	* * * snap fasteners and clasps by whatever name known, * * * made wholly or in chief value of iron or steel.	15 per centum ad valorem.
1913	167	Articles or wares not specially provided for in this section; * * * if composed wholly or in chief value of * * * brass.	20 per centum ad valorem.

COURT AND TREASURY DECISIONS.

Glove fasteners in two pieces, one part being a metal socket into which the other part fits, not being buttons in fact, and being shown to be known commercially as glove fasteners, and not as buttons, were held not dutiable as buttons under paragraph 414, but dutiable at 45 per cent ad valorem as articles or wares n. s. p. f., composed wholly or in part of iron, steel, copper, etc., under paragraph 193 of the tariff act of 1897.—T. D. 26934, G. A. 6240; following T. D. 25730, G. A. 5829 of 1904.

Clasps for dress fasteners attached to a tape and put up in 12-yard lengths, were held dutiable under paragraph 349 of the act of 1909, and not as snap fasteners under paragraph 427.—T. D. 34026, Abst. 34360.

Snap fasteners on tape, classified as manufactures of cotton, under paragraph 266 of the tariff act of 1913, and reported upon analysis to be metal chief value, were held dutiable as manufactures of metal, under paragraph 167; the record not showing that the articles in question were "snap fasteners * * * made wholly or in chief value of iron or steel," for which provision is made in paragraph 151.—Abst. 37342 of 1915.

HOOKS AND EYES.

SUMMARY.

Hooks and eyes, used as dress fasteners, are made by automatic machinery from brass or iron wire. Both the brass and iron hooks and eyes may be either tin plated or japanned. They have to a large extent been displaced in recent years by snap fasteners, and the industry is therefore not a growing one. The value of domestic production in 1914 is reported by the census at $1,394,745.

Imports in 1914 were valued at $27,878, a figure not reached during any other year from 1907 to 1919. No imports were reported by Commerce and Navigation Reports in 1918 and 1919.

No export statistics are available, but one manufacturer reports that some hooks and eyes are exported.

Hooks and eyes are produced in Germany, England, and Belgium.

The duty on hooks and eyes is 15 per cent ad valorem, to which rate it was reduced by the tariff act of 1913 from the rate of 4½ cents per pound plus 15 per cent ad valorem imposed by the act of 1909.

Hooks and eyes [1]*—Summary table.*

Year.	Domestic production.[2]	Imports for consumption.[3]		Amount of duty.[3]	Value per unit of quantity.	Actual or equivalent ad valorem rate.[3]
		Quantity.	Value.			
	Great gross.	*Pounds.*				*Per cent.*
1910		14,078	$2,991	$1,104	$0.212	36.91
1911		55,322	14,138	4,610	.256	32.61
1912		42,219	12,958	3,844	.307	29.66
1913		60,771	16,496	5,209	.271	31.58
1914	1,076,177	86,710	27,878	4,760	.321	17.07
1915		26,831	7,133	1,070	.266	15.00
1916		7,005	1,974	296	.282	15.00
1917		1,061	374	56	.352	15.00
1919			50	8		15.00
1920			3,401	510		15.00
1921			5,519	827		15.00

[1] No statistics available for domestic exports.
[2] Census year.
[3] Fiscal years ended June 30 for 1910–1917; calendar years thereafter.

GENERAL INFORMATION.

ACT OF 1913.

PAR. 151. * * * hooks and eyes, metallic; * * * not otherwise specially provided for * * * 15 per centum ad valorem.

DESCRIPTION.

The hooks and eyes covered by this survey are used as dress fasteners and are not to be confused with the hooks and eyes handled by the hardware trade and used as screen door and gate fasteners and for similar purposes. There are two general classes of hooks and eyes of the kind used for dress fasteners: (1) Brass, plated with tin or coated with japan; (2) iron or adamantine, plated with

tin or coated with japan. The hook part may be made with or without the "hump" feature which makes the fastening more secure. The eyes may be standard and round, or invisible and straight. Brass hooks and eyes are more expensive than those of iron, but are superior to the latter because they do not rust.

Buttons and snap fasteners are substitutes for hooks and eyes. Snap fasteners are gaining in popularity and to some extent have displaced hooks and eyes.

DOMESTIC PRODUCTION.

The Federal Census returns for 1914 show an output of 1,076,177 great gross of hooks and eyes, valued at $1,394,745. In addition thereto, needles and pins and hooks and eyes valued at $1,155,144 were produced by establishments engaged primarily in the manufacture of other products. By 1919 production had decreased to 745,819 great gross, valued at $833,321.

Materials.—The materials used are iron, steel, brass, tin, and japan. The steel, iron, and brass are domestic, the tin is imported, and the japan is made from imported lac and domestic or imported linseed oil.

Equipment.—Equipment consists mainly of automatic machines, which are manufactured in this country.

Methods of manufacture.—The wire of which the hooks and eyes are made comes to the factory in sizes ranging from the very fine wire used in producing the tiny size of hooks and eyes to the heavy wire used in the manufacture of No. 15, the horse blanket size. The automatic hook-and-eye machines work at such high speed that the operation is hardly visible. In the hook machine the coil of wire is so placed that it feeds directly into the machine. Steel fingers grasp the wire, cut off the desired length for a hook, make the thread eye, form the hook, and, in the hump type, turn up the hump. Another machine less complicated, makes the eye.

After being formed on the automatic machines the hooks and eyes are scoured and burnished and then plated with tin or coated with japan. Brass hooks and eyes are tinplated by an electric process. The last process is putting them on cards; they are usually sold mounted, consumers not caring to buy them in bulk. Carding may be done by machinery, but as recently as 1913 it was commonly done by hand as home work.

Organization.—The hook-and-eye industry is a comparatively small one. The census of 1914 reports production of hooks and eyes to the value of $1,394,745, of which $761,476 represented the value of those made of steel wire, and $633,269 those made of brass wire. In addition needles and pins thereto, and hooks and eyes valued at $1,155,144 were produced by establishments engaged primarily in the manufacture of other products. An important manufacturer of hooks and eyes estimates the value of production in 1914 at $4,000,000. Since 1914 the industry has not grown much, if any, because of the growing competition of the newer snap fastener industry. As the small total production is divided among 11 or more concerns, the industry is evidently one which does not require large factories for successful operation.

Geographical distribution.—Of the 11 firms engaged in 1920 in the hook-and-eye industry, 4 were in Connecticut, 3 each in New York and Pennsylvania, and 1 in Illinois.

History of the industry.—Hooks and eyes originated in the fourteenth century, and were called the crochet and loop. Redditch, England, was the first center of the machine-made hook-and-eye industry. The industry started in the United States in the first part of the nineteenth century.

Domestic production and consumption.—Domestic production is entirely adequate for domestic consumption.

Domestic exports.—Exports of hooks and eyes are not specified in Commerce and Navigation, but one manufacturer reports that they are exported in considerable amounts.

FOREIGN PRODUCTION.

Hooks and eyes are produced in Germany, England, and Belgium. It was asserted in the brief of the American Pin Co., in the Tariff Hearings of 1913, that the largest manufacturers in the world were located in Stohlberg, Germany.

IMPORTS.

From 1907 to 1913 imports varied in value from a minimum of $2,518 in 1908 to a maximum of $16,496 in 1913. In 1914 they rose to a value of $27,878. In 1915, probably because of the war, they fell to $7,133. In 1917 they were valued at only $374; during 1918 and 1919 no imports were recorded.

PRICES.

One concern reports that the price of its standard brass hooks and eyes from 1910 to September, 1919, was $5 per great gross for the smaller sizes and $6 per great gross for the larger sizes, both less a discount of 15 per cent and 7 per cent for cash. In September, 1919, the price list was increased 50 cents per great gross. No foreign prices are available for comparison.

TARIFF HISTORY.

Prior to 1897 hooks and eyes were not specifically enumerated. Under the act of 1890 they were dutiable at 45 per cent and under the act of 1894 at 35 per cent as manufactures of metal not specially provided for. They were specified in the act of 1897 and made dutiable at 5½ cents per pound and 15 per cent ad valorem. In 1909 the duty was reduced 1 cent per pound, and in 1913 the specific duty was dropped, leaving only the ad valorem duty of 15 per cent.

Manufacturers have asserted that under the old ad valorem rate in effect prior to 1897 the imports were undervalued and the duty was in part evaded. The specific duty could not be evaded, they added, and under the act of 1897 imports were largely reduced. No statistics bearing on this point are available, since no records of imports were kept before 1897. Since 1897 imports have, in fact, been small. In 1914, under the reduced duty of 15 per cent ad valorem imports rose to $27,878, an amount small in itself, but representing a relatively large increase over the imports valued at $16,496 in the

preceding year. No real test has been made of the effect of the lower rate of 15 per cent upon imports after the European supplies were practically cut off by the war in 1914, and neither German nor British producers as late as 1920 had any surplus that could be sold in the United States.

COMPETITIVE CONDITIONS.

The cost of raw materials is about the same in the United States as in England. But in labor costs, which one American manufacturer estimates at 60 per cent of total costs, English producers apparently have a substantial advantage over their American competitors. An American manufacturer, 80 per cent of whose employees are girls, reported to the Tariff Commission early in 1920 that he paid these workers $16 per week; English women and girls employed at similar labor received at that time about $8 for a 47-hour week. Since much of the labor in this industry is employed in operating automatic machines the speed of which is largely independent of the operator there is a fairly close relation between weekly wage rates and labor costs per unit of output. It appears from the foregoing that English manufacturers are able to produce hooks and eyes at a substantially lower cost than American manufacturers. Other European producers have similar advantages. More serious for American producers of hooks and eyes, however, than the competition of foreign producers of those articles, is the competition, both foreign and domestic, of the new and rapidly growing snap fastener industry producing a substitute article that is increasing in favor.

STATISTICAL MATERIAL.

Imports for consumption—Revenue.

HOOKS AND EYES, METALLIC, WHETHER LOOSE, CARDED, OR OTHERWISE, INCLUDING WEIGHT OF CARDS, CARTONS, AND IMMEDIATE WRAPPINGS AND LABELS.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal year:		*Pounds.*				*Per cent.*
1907	5½ cents per pound and 15 per cent.	23,164	$4,702	$1,979	$0.203	42.10
1908	....do	14,069	2,518	1,152	.179	45.73
1909	....do	14,210	3,657	1,330	.257	36.37
1910 [1]	....do	2,287	537	206	.235	38.42
1910 [2]	4½ cents per pound and 15 per cent.	11,791	2,454	899	.208	36.62
1911	....do	55,322	14,138	4,610	.256	32.61
1912	....do	42,219	12,958	3,844	.307	29.66
1913	....do	60,771	16,496	5,209	.271	31.58
1914 [3]	....do	12,840	4,030	1,182	.314	29.34
1914 [4]	15 per cent	73,870	23,848	3,577	.323	15.00
1915	....do	26,831	7,133	1,070	.266	15.00
1916	....do	7,005	1,974	296	.282	15.00
1917	....do	1,061	374	56	.352	15.00
Calendar year:						
1919	....do		50	8		15.00
1920	....do		3,401	510		15.00
1921	....do		5,519	827		15.00

[1] July 1 to Aug. 5, 1909, under act of 1897.
[2] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[3] July 1 to Oct. 3, 1913, under act of 1909.
[4] Oct. 4, 1913, to June 30, 1914, under act of 1913.

Hooks and eyes—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rate of duty.
		Prior to the tariff act of 1897 hooks and eyes were not specifically enumerated, and were dutiable as manufactures of metal at 45 per cent ad valorem under the acts of 1883 (par. 216) and 1890 (par. 215), and at 35 per cent ad valorem under the act of 1894 (par. 177).	
1897	180	Hooks and eyes, metallic, whether loose, carded, or otherwise, including weight of cards, cartons, and immediate wrappings and labels.	5½ cents per pound and 15 per cent ad valorem.
1909	180	.....do.....	4½ cents per pound and 15 per cent ad valorem.
1913	151	* * * hooks and eyes, metallic; * * * all the foregoing and parts thereof, not otherwise specially provided for in this section.	15 per cent ad valorem.

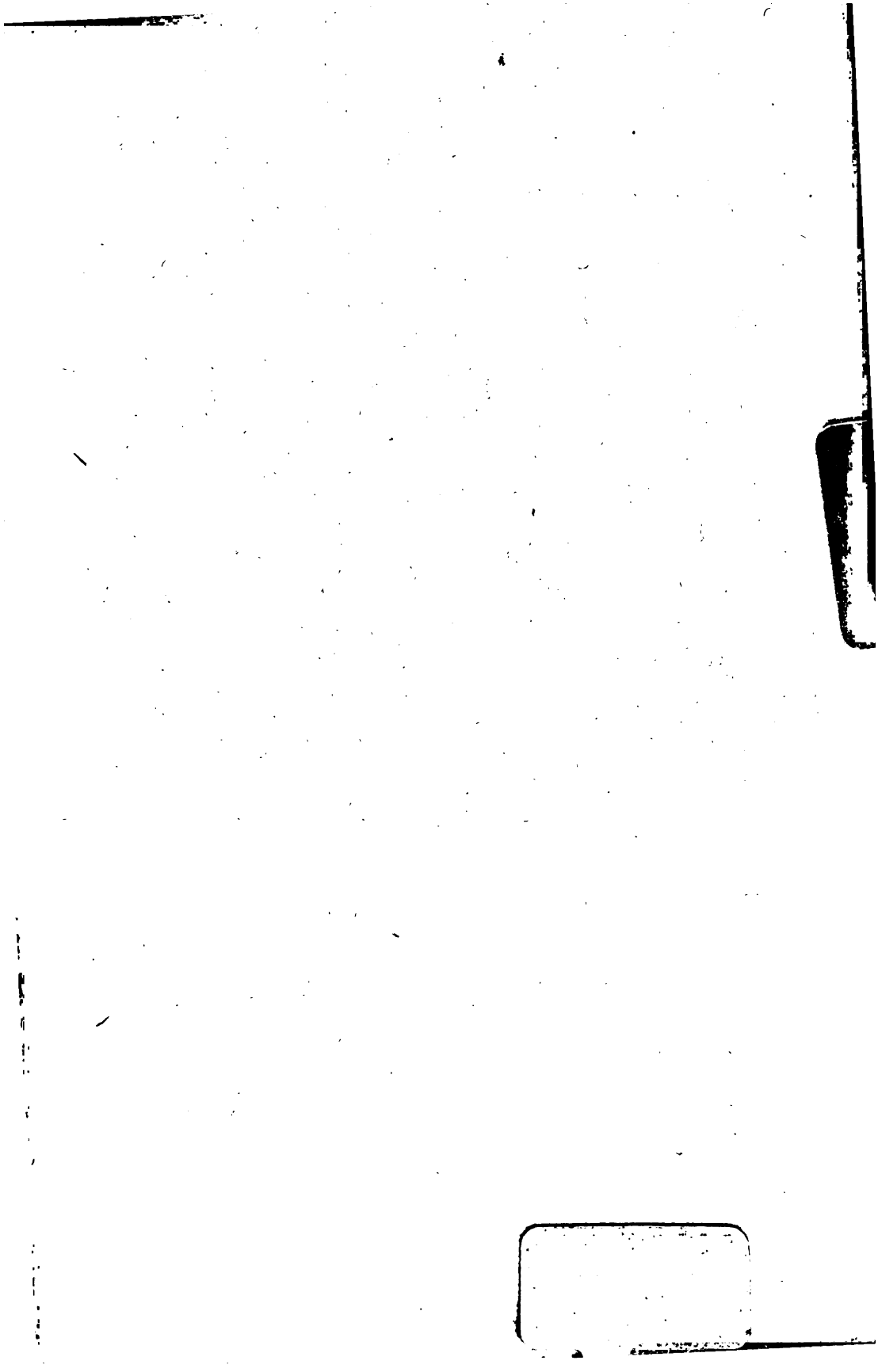
COURT AND TREASURY DECISIONS.

Hooks and eyes, manufactured of iron and coated with a hard, brilliant black varnish known as "japan," were held dutiable as "japanned ware" and not as manufactures of iron under the act of 1883. (Cohn *v.* Erhardt, 44 Fed., 747, in effect overruling T. D. 7932 and 9159, holding similar hooks and eyes dutiable as manufactures of metal.) (Writ of error, U. S. Supreme Court, dismissed, 145 U. S., 637); followed in G. A. 863 (T. D. 11872).

Hooks imported without eyes were held dutiable under the provision in the act of 1897 for "hooks and eyes," which was construed to apply to hooks or eyes as well as to both hooks and eyes. G. A. 5075 (T. D. 23517).

METAL BUTTONS.

(See paragraph 339.)



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UNITED STATES TARIFF COMMISSION
WASHINGTON

TARIFF INFORMATION SURVEYS

ON THE ARTICLES IN

PARAGRAPHS 147, 148, 149, AND 150 OF THE TARIFF ACT OF 1913

AND RELATED ARTICLES IN OTHER PARAGRAPHS

COPPER AND COPPER ALLOYS

Paragraph 114:
Copper or Brass Wire

Paragraph 145:
Argentine, Albata, and German silver

Paragraph 147:
Copper Rolling Mill Products

Paragraph 148:
Gold Leaf. (See par. 146)

Paragraph 149:
Silver Leaf. (See par. 146)

Paragraph 167:
Brass Rolling Mill Products

Paragraph 413:
Bells

Paragraph 430:
Old Brass

Paragraph 460:
Copper Alloys, Unmanufactured

Paragraph 461:
Copper Ore, Matte, and Cast Metal

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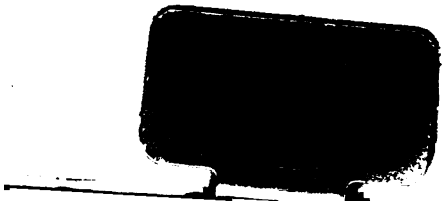

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COPPER AND COPPER ALLOYS.

COPPER ORE, MATTE, REGULUS, CEMENT, AND SCALE.

SUMMARY.

Domestic conditions.—The United States is the largest producer of copper ore in the world. The production of late years has been well over 50 per cent of the world total.

The industry is well organized and practically the entire production is in the hands of eight financial groups, who control a large part of the foreign metal as well.

Ores and mattes are the most important crude products imported. The supply comes from Canada, Spain, Mexico, and Chile. It is all smelted and refined at domestic plants and sold with the domestic production.

The exports are limited to shipments to Mexico and Canada by mines near the border to smelters located in those countries. The metal produced is usually sent back to the United States for refining.

Foreign conditions.—Japan, Spain, Mexico, Chile, Canada, and Peru are the chief foreign producers. Of these Japan is the only refining nation, but all of the others smelt a large part of their production to crude metal before exporting.

In the future Canada, Chile, Mexico, South Africa, and Russia should become large producers.

Competitive conditions and tariff considerations.—Most of the world's largest copper deposits lie within the borders of the United States and domestic miners lead the world in every branch of the industry. Owing to our large export surplus of metallic copper, United States quotations set the price for the metal in foreign markets.

The imports of ore and mattes, though large, form a relatively small percentage of the total as compared to the domestic consumption. Foreign shippers to this country are to a large extent controlled by domestic producers.

Copper ore, matte, regulus, and cement—Summary table.

Calendar year.	Domestic production (copper content).[1]	Imports for consumption (copper content).	Domestic exports.	Ratio to production.		Value (imports for consumption).	Value per unit of quantity.	Equivalent ad valorem rate.
				Imports.	Exports.			
	Pounds.	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*		*Cents.*	
1910	1,080,159,509	.....	[2] 43,784	.....	.....	.....	.....	Free.
1911	1,097,232,749	67,123,401	[2] 57,915	6.11	.....	$6,908,775	10.3	Do.
1912	1,243,268,720	104,489,844	[2] 66,171	8.40	.....	12,457,669	11.9	Do.
1913	1,224,484,098	106,547,057	[2] 65,684	8.50	.....	13,305,559	12.5	Do.
1914	1,150,137,192	100,813,504	[2] 43,529	8.75	.....	11,678,456	11.6	Do.
1915	1,388,009,327	110,427,858	[2] 57,731	7.95	.....	13,636,209	12.3	Do.
1916	1,927,850,548	172,330,581	[3] 5,784,768	8.94	0.300	28,980,497	16.8	Do.
1917	1,886,120,721	172,624,656	[3] 5,957,295	9.15	.316	32,747,353	19.0	Do.
1918	1,908,533,595	158,035,881	[3] 3,259,839	8.28	.171	33,417,615	21.2	Do.
1919	1,310,541,529	130,712,407	[4] 668,667	9.97	.051	24,736,937	18.9	Do.
1920	.....	111,672,483	[3] 440,906	.....	.....	21,026,381	18.8	Do.

[1] Smelter production of domestic copper, pounds.
[2] Tons, gross.
[3] Copper contents, pounds.

General Information.

PARAGRAPH 461, TARIFF ACT OF 1913.

Copper ore; regulus of, and black or coarse copper, and copper cement; * * * copper scale: Free.

DESCRIPTION AND USES.

The ores of copper are of three main classes: (1) Native, (2) oxide, and (3) sulphide.

(1) *Native copper* ores are those in which copper occurs in the metallic state. The largest and practically the only valuable occurrence is in Michigan.

(2) *Oxide* ores include such minerals as:

Cuprite: Copper oxide, 88 per cent copper.
Tenorite: Copper oxide, 80 per cent copper.
Malachite: Copper carbonate, 57 per cent copper.
Azurite: Copper carbonate, 55 per cent copper.
Atacamite: Copper chloride, 54 per cent copper.
Brochantite: Copper sulphate, 56 per cent copper.
Chrysocolla: Copper silicate, 38 per cent copper.

These occur in the top of ore deposits and usually give way to sulphides at depth. Atacamite and brochantite are soluble in water, so are found only in arid regions, notably Chile.

(3) The more important *sulphide* copper minerals are:

Chalcocite: Copper subsulphide, 79.8 per cent copper.
Covellite: Copper sulphide, 66.4 per cent copper.
Bornite: Copper-iron sulphide, 50 to 70 per cent copper.
Enargite: Copper-arsenic sulphide, 48 per cent copper.
Chalcopyrite: Iron copper sulphide, 34 per cent copper.
Tetrahedrite: Copper antimony sulphide, 15 to 48 per cent copper.

Sulphides are the primary ores of copper. They are the compounds from which oxide ores are formed by the action of oxygen contained in surface waters.

Concentrates are ores from which the barren rock has been removed, leaving the copper minerals more or less pure. They range in copper content from 10 to 35 per cent.

Regulus, black copper, and copper mattes are fire concentrated ores of copper containing 40 to 90 per cent of the metal. The balance is sulphur and iron. They are produced as intermediate products in copper smelting.

Copper cement is metallic copper recovered from copper solutions, mine waters, etc., by the addition of metallic iron.

Copper scale is a by-product of smelting and consists mainly of copper oxide.

USES.

Aside from the natural use of copper mattes, ore, and concentrates as the sources of copper they have little or no commercial value. The sulphur in sulphide ores is utilized to some extent for the manufacture of sulphuric acid, and in some localities salts of copper are made direct from the ore.

Copper is, next to iron and steel, the most useful metal. It is very malleable and ductile and has a high electrical conductivity. These properties render it unequaled for electrical uses, and fully 50 per cent of the production is used in this way. The alloys with zinc (brass) and with tin (bronze) are second in importance.

DOMESTIC PRODUCTION.

The copper-mining industry consisted in 1918 of over 1,000 mines with a production of over 62,000,000 short tons per annum. Except for two large deposits in South America and one in Spain, all of the more important copper properties in the world are located within the borders of the United States. The domestic production of copper is over half the world total. The bulk of the domestic copper is produced by a few very large mines. This plays an important part in industrial control.

Equipment.—The United States copper deposits are peculiarly adapted to large-scale operation and production. The operators of the large producers control practically the entire production of the United States through the ownership of smelters and refineries, which are only profitable when large tonnages of ore are available.

Domestic producers and smelters lead the world in every branch of copper mining and metallurgy. Machines are used in place of manual labor in every possible way, and this has made is possible to work at a profit deposits of low-grade ore that would be valueless under other conditions.

Methods of production.—Copper ore is generally mined by means of shafts or tunnels, the ore being trammed or hoisted to the surface.

The deposits are so large that some mines have worked continuously for over 50 years, and this fact justifies the elaborate surface plants that have been erected to concentrate the ore. Large-scale production combined with efficient concentrating methods make profitable the mining of very low-grade ores. This is particularly true in the Michigan district, where ores containing less than 1 per cent of copper and practically no precious metals have been able to hold their own against the rich sulphide ores of the Rocky Mountain region. It should be stated, however, that these ores, containing as they do metallic copper, are more easily concentrated than the sulphide ores and do not require as expensive metallurgical treatment to fit the metal for the market.[1]

There are several large deposits of very low-grade ore that are worked by quarrying methods, the ore being handled with steam shovels.

In every case water is the agent used to separate the values from the rock. The heavy copper minerals or metal sinks in the jigs or sticks to the tables while the light quartz or limestone is carried away. Recently the flotation process has increased recoveries from low-grade slimes and converted this product from a loss to a source of rich concentrates.

Organization.—The large domestic copper deposits and at least three of the largest foreign properties are all controlled by eight groups of financial interests.[1]

---

[1] See copper metal survey.

The American Smelting & Refining Co. with its affiliations is the largest factor.

The Anaconda Copper Mining Co. is second in importance, followed by the large Michigan producers (Calumet and Hecla).

The concentrated ownership and the capital requirements for smelting and refining plants enable the large producers to control the metal until it is marketed, usually as refined ingots or pigs, but in some cases the producers control rolling mills, so that their product is ready for the consumer as plates, sheets, or wire.

Geographical distribution.—There are four principal copper-producing regions in the United States, but large single mines lying outside these districts produce important tonnages of ore.

The Arizona district is the newest and at present is the first in importance. The ore is generally fairly rich and is either oxide or sulphide. Mines in this region produced 769,521,729 pounds of copper in 1918.

Montana is second in importance. The producing area is confined to the city of Butte and a small district near by, but the copper veins are so large and numerous that, although they have been mined for almost 50 years, the production continues as large as ever, and reserves for several years are in sight. Montana produced 326,426.761 pounds of copper in 1918.

The mines in Michigan were the first in the United States to be worked on a large scale. The first production from this district was marketed in 1845, and for some years, or until the California mines were developed, this was the only domestic source of copper. During the years immediately preceding the late war the production was nearly stationary, and in 1913 showed a large decrease from previous records. The ore is very low grade, and in periods of low prices only the largest producers can operate at a profit.

Utah and Nevada together produce more copper than any single State, with the exception of Arizona. The deposits in these States are very widely distributed, and one at least is of very large size.

Alaska has recently entered the ranks of the copper producers, and as railroad facilities are improved the production from this Territory will show marked increase. There are several large mines in New Mexico. The occurrences are similar to the Arizona deposits, and are often classed with the latter.

California and Tennessee contain single large mines, and 15 other States have productions worthy of mention.

History of the industry.—The ore deposits of Michigan and Tennessee were worked by the Indians long before the discovery of America. Copper was first mined by white men in Connecticut (1709). Later mining was carried on in several of the Eastern States, but only on a small scale.

Copper was mined in California in 1860, but shortly before this time the Lake Superior deposits were opened up, and Michigan was soon the leading producer. In 1887 Montana took the lead, only to lose it to Arizona after some years. Michigan is now third in importance.

Domestic production and consumption.—The United States has been for the last 40 years the world's largest copper producer. The normal consumption is about two-thirds the mine production, and the large surplus, amounting to nearly half a billion pounds annually, is ex-

ported. Practically all of the ore is smelted in the United States, the only exceptions being exports from mines near the Canadian and Mexican borders to smelters in those countries. The matte or metal produced is to a large extent imported for refining.

War demand caused an increase in the (see summary table, p. 9) production of copper from 1,235,569,727 pounds in 1913 to 2,005,875,312 pounds in 1916.[1] The production has decreased since 1916, due first to labor troubles in the principal mining districts and later to the decrease in price. Unless there is a recurrence of war-time prices there seems to be little likelihood that the mark set that year will be exceeded in the future. During 1919 the price of copper dropped to 18 to 19 cents per pound, and with labor wages remaining the same or higher than during the war many high-cost mines were forced to close down. The decrease in price was due for the most part to the large war stocks on hand, and it is probable that as these are exhausted prices will improve and production be increased. The 1919 production was 1,441,642,592 pounds.

Domestic exports.—Ores and unrefined copper-smelting products never have been important factors in export. We are essentially a smelting and refining nation, so that except where mines are located close to the international boundary and to foreign smelters there is no reason for export.

In normal years the tonnage of ore, matte and regulus, etc., exported is less than two-tenths of 1 per cent of the total ore mined. The exports remained fairly constant until the outbreak of the war, but since that time the tonnage has decreased, due to unsettled conditions in Mexico and to war-time restrictions in Canada.

FOREIGN PRODUCTION.

It is interesting to note that, except for the United States, Spain, and Japan, all of the world's principal copper producers are undeveloped nations, whose consumption of the metal is small. For this reason almost the entire production is available for export. Japan is the most important foreign producer, followed, in the order named, by Spain, Portugal, Mexico, Australasia, Chile, Canada, Peru, and Germany. Japan produces less than 15 per cent as much as the United States.

The war increased production in some foreign countries and demoralized the industry in others. In South America and Japan production was increased enormously. The production of copper in South Africa and Australia was curtailed to some extent, due to scarcity of shipping. Mexico and Russia suffered from disturbed political conditions during the later years of the war, and no great increase in production can be expected until stable governments are in control in those countries. Labor shortage is another factor that acted to decrease production in the British colonies, especially Canada.

In the future Chile, Mexico, Canada, South Africa, and Russia may become large producers. They all have virgin areas of promising territory and large known deposits.

[1] Total domestic production of copper contents of ore mined.

IMPORTS.

Copper ore is, except for blister copper, the most important copper-bearing material imported. The imports increased from 46,000,000 pounds copper content in 1911 to 157,000,000 pounds in 1916. The imports decreased during 1917 and 1918 due to unsettled conditions in Mexico and to the decrease in war demand. The imports come almost entirely from Mexico, Chile, and Peru, and as smelting facilities are increased in those countries the tonnage of ore exported will decrease, matte and blister copper taking its place.

Prior to 1918 the imports of matte and regulus never amounted to more than 30,000,000 pounds copper content. A large increase was recorded in 1918 as a result of the world shortage, and in 1919 (due to the interval between the time the ore was mined and when it was smelted) the copper contents of the imports exceeded 40,000,000 pounds. In 1920 they dropped to below the prewar average.

The bulk of the copper matte imported comes from Canada and Chile, where converter capacity is limited.

PRICES.

It is impossible to set any fixed price for copper ore or matte. It is generally sold on a basis of the copper content less a smelting loss, but there are so many factors entering into the calculation that given two ores containing the same percentage of copper one may be much more valuable than the other. Freight and handling charges are often large items of expense. Quartz, iron, and lime content in some cases are penalized and in others command a premium. Zinc is always penalized if present in quantity, but precious metals are paid for at practically full market value.

For details regarding ore contracts reference should be made to volume 108, Nos. 20 and 21, Engineering and Mining Journal. The various factors entering into the value of an ore are there discussed and specimen contracts given.

TARIFF.

Copper ores have been on the free list since 1894. Prior to that time ores were taxed on their copper content. Under the act of 1883 the duty was 2½ cents per pound of fine copper, but this was reduced to one-half cent by the act of 1890.

Copper matte and regulus was dutiable at 3½ cents per pound of copper content under the act of 1883, but this was cut to 1 cent in 1890, and in 1894 the material was placed on the free list.

COMPETITIVE CONDITIONS AND TARIFF CONSIDERATIONS.

The preeminent position of domestic copper miners and smelters due to our large production enables the United States producers to dominate the foreign copper market. The imports of ore, matte, and metal, though large, are small compared with the domestic output, and, furthermore, foreign mines are, to a large extent, owned by the financial groups in control of the industry in the United States.

Domestic copper costs during the war were slightly higher than South American costs but lower than those of Canada. The question of foreign costs, however, does not affect the tariff situation. Europe have our export surplus, and so long as the foreign export

surplus is unable to meet the European demand costs in the United States will be the controlling factor of the industry.

The vast quantities of recoverable war copper in shell casings, etc., will no doubt exercise some influence on the foreign market for some time. This high-grade brass will reenter the market in large amounts.

Copper (smelter production)—Production in United States.

[From Mineral Resources, United States Geological Survey.]

States.	1910		1911		1912	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
Alaska	4,311,026		22,314,889		31,926,209	
Arizona	297,250,538		303,202,532		359,322,096	
California	45,760,200		35,835,651		31,516,471	
Colorado	9,307,497		9,791,861		7,963,620	
Idaho	6,877,515		4,514,116		7,182,185	
Michigan	221,462,984		218,185,236		231,112,228	
Montana	283,078,516		271,816,098		308,794,483	
New Mexico	3,784,609		2,880,400		29,170,400	
Nevada	64,494,640		65,581,015		83,413,900	
Oregon	22,022		125,943		311,860	
Utah	125,185,455		142,340,215		132,150,052	
Washington	65,021		195,503		1,069,938	
Wyoming	217,127		130,499		25,080	
All other	18,342,359		20,358,791		19,310,298	
Total	1,080,159,509	$137,180,000	1,097,232,749	$137,154,000	1,243,268,720	$205,139,000

States.	1913		1914		1915	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
Alaska	23,423,070		24,985,847		70,095,286	
Arizona	404,278,809		382,449,922		432,467,690	
California	32,492,265		29,784,173		37,658,444	
Colorado	9,052,104		7,316,066		7,272,178	
Idaho	8,711,490		5,875,205		6,217,728	
Michigan	155,715,286		158,009,748		238,956,410	
Montana	285,724,467		236,805,845		268,283,040	
New Mexico	50,196,881		64,204,703		62,817,234	
Nevada	85,209,536		60,122,904		67,757,322	
Oregon	77,812		5,599		797,471	
Utah	148,057,450		160,589,660		175,177,695	
Washington	732,742		683,602		903,661	
Wyoming	362,235		17,082		351,871	
All other	20,449,951		19,286,836		18,673,497	
Total	1,224,484,098	$189,795,000	1,150,137,192	$152,968,000	1,388,009,527	$242,902,000

States.	1916	1917	1918
	Pounds.	*Pounds.*	*Pounds.*
Alaska	113,823,064	84,759,086	67,081,648
Arizona	694,847,307	719,035,514	769,521,729
California	43,400,876	44,933,846	44,150,761
Colorado	9,536,193	10,054,951	7,591,570
Idaho	7,248,794	6,446,224	5,836,795
Michigan	269,794,531	268,508,091	231,096,158
Montana	352,139,768	276,225,977	326,426,761
New Mexico	79,863,439	107,893,615	96,559,580
Nevada	100,816,724	115,028,161	106,266,603
Oregon	2,433,567	1,105,097	2,630,499
Utah	232,335,950	227,840,447	230,964,908
Washington	2,473,481	2,051,416	2,330,568
Wyoming	1,784,351	2,019,767	866,698
All other	17,352,503	20,518,529	17,209,317
Total	1,927,850,548	1,886,120,721	1,908,533,595

Copper—Production in principal foreign countries.

[From Mineral Industry.]

Countries.	1910	1911	1912	Countries.	1910	1911	1912
	Metric tons.	*Metric tons.*	*Metric tons.*		*Metric tons.*	*Metric tons.*	*Metric tons.*
Africa	15,449	17,252	16,633	Peru	27,375	28,500	26,483
Australasia	40,962	42,512	47,774	Russia	22,670	25,747	33,550
Austria-Hungary	2,276	2,566	4,024	Spain-Portugal	51,080	51,748	59,876
Canada	23,810	25,570	34,213	United Kingdom	508	405	405
Chile	38,346	33,088	39,204	Norway	10,592	9,576	11,156
Cuba	3,538	3,753	4,393	Sweden	2,032	2,032	3,957
Germany	25,105	22,363	24,304	All other	4,552	6,176	6,073
Italy	3,272	2,642	2,337				
Japan	50,703	52,303	62,486	Total	384,774	388,117	450,485
Mexico	62,504	61,884	73,617				

Countries.	1913	1914	1915	Countries.	1913	1914	1915
	Metric tons.	*Metric tons.*	*Metric tons.*		*Metric tons.*	*Metric tons.*	*Metric tons.*
Africa	25,411	24,135	27,327	Peru	25,715	23,647	32,410
Australasia	47,326	37,590	32,512	Russia	42,970	31,938	25,881
Austria-Hungary	4,135	3,310	.....	Spain-Portugal	54,696	37,099	46,200
Canada	34,587	34,027	47,202	United Kingdom	305	347	238
Chile	40,195	40,876	52,081	Norway	11,796	2,860	2,867
Cuba	3,517	6,251	8,836	Sweden	6,891	4,692	4,561
Germany	25,309	30,480	[1] 35,000	All other	4,283	2,743	[1] 3,000
Italy	1,626	2,410	1,840				
Japan	73,152	68,058	75,415	Total	454,729	386,800	426,339
Mexico	52,815	36,337	30,969				

Countries.	1916	1917	1918	Countries.	1916	1917	1918
	Metric tons.	*Metric tons.*	*Metric tons.*		*Metric tons.*	*Metric tons.*	*Metric tons.*
Africa	34,572	45,138	31,110	Peru	41,625	45,620	44,800
Australasia	35,000	38,100	33,838	Russia	[1] 20,877	[1] 16,000	[1] 5,000
Canada	47,985	50,626	52,693	Spain-Portugal	[1] 42,000	[1] 42,000	[1] 41,000
Chile	71,430	83,100	85,850	United Kingdom	282	190	.....
Cuba	7,816	10,313	12,337	Norway	1,162	1,810	.....
Germany	[1] 45,000	[1] 45,000	[1] 40,000	Sweden	3,181	4,423	2,956
Italy	1,867	1,248	1,114	All other	[1] 4,000	[1] 29,000	[1] 29,000
Japan	81,280	111,256	95,800				
Mexico	55,128	47,503	75,529	Total	493,205	571,327	551,027

[1] Estimated.

Copper ore—Imports by countries.

FISCAL YEARS.

Imported from—	1910			1911			1912		
	Gross weight.	Copper contents.	Value.	Gross weight.	Copper contents.	Value.	Gross weight.	Copper contents.	Value.
	Long tons.	*Pounds.*		*Long tons.*	*Pounds.*		*Long tons.*	*Pounds.*	
Mexico	169,007	25,549,251	$2,929,907	107,402	19,158,091	$2,136,917	89,174	15,771,758	$1,761,127
Chile	38,456	12,480,796	1,411,992	27,829	11,166,644	1,286,947	28,101	11,189,573	1,523,014
Spain	114,797	5,347,117	669,744	104,584	3,786,674	471,364	145,386	6,029,983	758,409
Peru	10,071	3,019,808	401,713	8,220	3,939,908	481,476	4,030	2,049,469	272,273
Germany	2,027	1,390,140	175,850	149	81,553	10,432	1,237	614,997	70,813
German Africa	4,009	1,844,161	192,366	7,104	2,921,684	252,625	4,592	2,327,255	256,569
Cuba	36,534	6,928,020	552,231	76,629	12,604,602	795,353	75,576	11,585,783	727,229
Canada	12,040	580,656	46,437	19,766	1,303,896	115,714	82,099	13,783,319	1,192,197
Venezuela	29	8,002	1,000	.....	.....	.....	.....	.....	.....
All other	11,202	1,190,572	134,113	19,151	2,201,723	245,238	3,082	490,908	69,747
Total	398,172	58,338,523	6,515,353	370,834	57,164,775	5,796,066	433,277	63,843,045	6,631,378

Copper ore—Imports by countries—Continued.

FISCAL YEARS—Continued.

Imported from—	1913			1914			1915		
	Gross weight.	Copper contents.	Value.	Gross weight.	Copper contents	Value.	Gross weight.	Copper contents.	Value.
	Long tons.	*Pounds.*		*Long tons.*	*Pounds.*		*Long tons.*	*Pounds.*	
Mexico	84,610	17,627,016	$2,092,559	88,214	18,912,172	$2,287,875	59,386	11,186,451	$1,365,101
Chile	41,332	14,096,944	2,242,784	46,803	15,213,097	1,974,429	48,141	17,913,806	2,059,347
Spain	148,185	5,893,661	862,437	92,387	4,220,544	590,315	40,903	1,499,381	196,007
Peru	5,967	2,707,485	449,917	17,299	5,063,759	751,582	5,508	2,321,138	294,148
Germany	577	113,800	18,597	9,788	3,605,959	516,747	2,952	1,281,443	153,826
German Africa	13,772	3,215,575	378,918	.....	.....	.....	.....	.....	.....
Cuba	35,905	6,337,595	676,245	29,177	10,216,596	1,270,182	61,080	24,291,760	2,680,268
Canada	138,518	30,272,355	2,707,489	148,618	27,875,378	2,430,904	115,700	18,825,753	1,649,547
Venezuela	.....	.....	.....	9,632	1,765,361	207,517	5,500	1,038,465	144,924
All other	901	147,889	20,162	2,989	715,864	107,693	394	65,413	5,233
Total	469,767	80,412,320	9,444,108	444,907	87,588,730	10,137,244	339,564	78,423,610	8,548,401

Imported from—	1916			1917			1918		
	Gross weight.	Copper contents.	Value.	Gross weight.	Copper contents.	Value.	Gross weight.	Copper contents.	Value.
	Long tons.	*Pounds.*		*Long tons.*	*Pounds.*		*Long tons.*	*Pounds.*	
Mexico	49,977	8,233,074	$1,120,139	31,382	4,503,684	$999,824	25,832	4,338,392	$854,002
Chile	66,640	31,853,531	4,507,902	67,861	27,525,119	4,840,321	58,007	25,968,150	5,015,241
Spain	59,919	2,705,629	485,611	28,989	1,254,159	284,477	.....	.....	.....
Peru	9,384	3,341,764	543,523	8,658	3,944,903	833,085	7,547	2,921,794	673,022
German Africa	.....	.....	.....	3,900	1,048,320	236,691	.....	.....	.....
Cuba	69,789	32,282,580	4,846,995	86,824	43,366,103	5,824,698	78,681	33,133,480	4,041,058
Canada	166,496	31,567,008	3,670,868	180,469	31,180,792	5,323,588	168,234	31,861,999	5,906,004
Venezuela	9,830	1,916,049	338,577	10,099	1,594,166	418,300	20,711	3,460,674	722,507
All other	16,176	2,908,042	445,654	24,209	5,463,702	1,027,990	18,111	3,006,814	1,106,947
Total	448,211	114,807,677	15,959,269	442,391	119,880,948	19,788,974	377,124	104,691,803	18,318,781

CALENDAR YEARS.

Imported from—	1918			1919		
	Gross weight.	Copper contents.	Value.	Gross weight.	Copper contents.	Value.
	Long tons.	*Pounds.*		*Long tons.*	*Pounds.*	
Mexico	17,027	3,373,084	$674,333	6,623	918,091	$175,388
Chile	33,862	14,707,473	3,185,540	20,867	7,636,963	1,519,934
Spain	.....	.....	.....	47,632	2,157,072	336,368
Peru	1,901	1,200,879	278,368	1,521	1,165,768	227,661
Cuba	70,861	23,861,119	3,941,413	41,155	11,107,064	2,016,791
Canada	151,821	30,060,903	6,173,634	117,932	24,487,478	4,662,811
Venezuela	4,560	662,422	109,893	2,638	425,802	92,634
All other	10,798	3,006,133	800,845	14,178	1,818,273	383,981
Total	290,930	76,872,013	15,164,026	252,546	49,716,511	9,415,568

Copper matte and regulus—Imports by countries (fiscal years).

Imported from—	1910			1911			1912		
	Gross weight	Copper contents.	Value.	Gross weight	Copper contents.	Value.	Gross weight	Copper contents.	Value.
	Long tons.	*Pounds.*		*Long tons.*	*Pounds.*		*Long tons.*	*Pounds.*	
Chile	7,449	7,301,072	$928,320	6,574	6,116,107	$682,786	9,381	7,997,911	$1,009,949
Peru	236	224,024	29,217	183	151,306	18,688	4,317	4,961,746	715,030
Canada	9,778	9,090,454	881,943	9,506	8,238,092	762,579	9,109	7,017,619	711,762
Germany	2,327	1,918,273	248,206	459	331,136	34,567	530	533,838	63,401
German Africa	2,023	2,206,589	240,732	1,519	1,683,891	170,144	940	1,023,302	110,748
Argentina	2,834	1,506,329	200,063	876	782,639	94,652	153	175,937	24,469
All other	2,302	1,768,245	228,711	11,499	924,023	100,060	4,864	723,416	96,445
Total	26,949	24,016,986	2,757,192	30,616	18,222,193	1,863,476	29,294	22,433,769	2,731,804

Copper matte and regulus [1]—Imports by countries (fiscal years.)

Imported from—	1913			1914			1915		
	Gross weight	Copper contents.	Value.	Gross weight	Copper contents.	Value.	Gross weight	Copper contents.	Value.
	Long tons.	*Pounds.*		*Long tons.*	*Pounds.*		*Long tons.*	*Pounds.*	
Chile	12,272	13,436,913	$2,165,418	13,345	13,239,555	$2,004,898	14,602	14,329,582	$1,830,925
Peru	6,385	7,930,376	1,291,489	5,192	5,758,582	866,211	84	86,956	12,563
Canada	4,168	2,794,493	335,329	3,629	2,814,234	303,689	7,312	5,272,322	613,385
Germany	990	450,051	74,404	1,494	586,258	78,918	.....	.....	.....
German Africa	592	629,111	82,073	.....	.....	.....	.....	.....	.....
Argentina	218	167,804	32,152	.....	.....	.....	.....	.....	.....
All other	6,487	1,520,607	242,520	10,112	2,234,115	306,024	8,035	1,854,615	223,267
Total	31,112	26,929,355	4,223,385	33,772	24,682,744	3,559,740	30,033	21,543,475	2,680,140

[1] Stated separately after 1915.

Copper matte and regulus, coarse metal and cement [1]—Imports by countries (fiscal years).

Imported from—	1916			1917			1918		
	Gross weight	Copper contents.	Value.	Gross weight	Copper contents.	Value.	Gross weight	Copper contents.	Value.
	Long tons.	*Pounds.*		*Long tons.*	*Pounds.*		*Long tons.*	*Pounds.*	
Chile	13,608	11,294,735	$1,965,529	12,322	9,777,306	$2,645,973	10,051	9,739,257	$2,342,239
Canada	7,077	5,301,645	978,034	809	656,917	138,288	.....	.....	.....
Mexico	2,487	1,210,375	230,754	1,443	1,751,076	419,344	8,440	11,162,953	2,464,319
Venezuela	3,143	930,906	173,950	651	361,760	68,293	895	321,487	62,174
Peru	909	794,113	131,572	1,499	1,295,673	306,939	620	578,169	133,631
United Kingdom	460	159,522	29,412	1,292	601,074	126,478	1,323	784,130	201,612
Cuba	103	103,696	23,876	340	472,572	101,004	.....	.....	.....
All other	384	291,913	54,174	754	604,607	141,332	329	283,597	76,001
Total	28,171	20,086,905	3,587,201	19,110	15,520,985	3,947,651	21,658	22,869,596	5,279,976

[1] Included in "Matte and regulus" prior to 1916.

Copper matte and regulus, coarse metal and cement—Imports by countries (calendar years).

Imported from—	1918			1919		
	Gross weight.	Copper contents.	Value.	Gross weight.	Copper contents.	Value.
	Long Tons.	*Pounds.*		*Long Tons.*	*Pounds.*	
Chile	4,516	4,239,615	1,034,989	6,582	6,407,432	$1,228,827
Canada	1,708	787,821	155,925	2,424	2,105,357	264,228
Mexico	18,235	22,638,810	5,008,109	21,869	28,852,151	5,179,629
Venezuela	1,341	674,223	145,067	2,404	999,191	224,999
Peru	2,003	2,380,831	510,273	298	304,530	56,050
United Kingdom	1,345	773,076	197,039	444	201,706	42,449
Cuba	100	94,080	22,000	3,200	925,295	200,000
All other	2,836	2,488,138	585,799	350	529,810	127,154
Total	32,084	34,076,594	7,659,201	37,571	40,325,472	7,323,336

Copper cement [1]—Imports by countries (fiscal years).

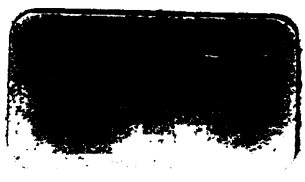
Imported from—	1910		1911		1912		1913	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*		*Pounds.*	
Cuba	273,132	$10,925	172,000	$8,600	.....	.....	.....	.....
Austria-Hungary	246,400	22,920	.....	.....	.....	.....	.....	.....
Spain	.....	.....	.....	.....	133,825	$10,389	30,494	$2,515
United Kingdom	.....	.....	200	24	.....	.....	.....	.....
Peru	.....	.....	.....	.....	.....	.....	2,330	253
Germany	.....	.....	.....	.....	.....	.....	1,484	166
Total	519,532	33,845	172,200	8,624	133,825	10,389	34,308	2,934

[1] Included in "All other articles" after 1913.

Copper concentrates [1]—Imports by countries (fiscal years).

Imported from—	1916			1917			1918		
	Gross weight.	Copper contents.	Value.	Gross weight.	Copper contents.	Value.	Gross weight.	Copper contents.	Value.
	Long Tons.	*Pounds.*		*Long Tons.*	*Pounds.*		*Long Tons.*	*Pounds.*	
Mexico	65,642	14,737,664	$2,815,710	141,369	31,185,495	$7,930,764	148,053	34,685,235	$8,461,933
Cuba	6,900	2,403,520	381,236	8,000	2,579,920	469,168	11,540	3,877,440	896,040
Canada	1,066	523,200	44,900	65	36,422	7,350	994	57,094	12,168
Asia: Chosen	1,629	448,347	62,828	1,890	1,452,742	267,122	.....	.....	.....
Panama	.....	.....	.....	29	31,331	8,705	.....	.....	.....
Chile	.....	.....	.....	252	169,478	40,764	.....	.....	.....
Peru	.....	.....	.....	250	440,920	60,778	36	31,312	6,515
British South Africa	.....	.....	.....	237	267,998	54,806	375	462,000	115,845
Total	75,237	18,112,731	3,304,674	152,092	36,164,306	8,839,457	160,998	39,093,081	9,492,501

[1] Included in "Matte and regulus" prior to 1916.



UNITED STATES TARIFF COMMISSION
WASHINGTON

TARIFF INFORMATION SURVEYS

ON THE ARTICLES IN

PARAGRAPHS 147, 148, 149, AND 150 OF THE TARIFF ACT OF 1913

AND RELATED ARTICLES IN OTHER PARAGRAPHS

COPPER AND COPPER ALLOYS

Paragraph 114:
Copper or Brass Wire
Paragraph 145:
Argentine, Albata, and German silver
Paragraph 147:
Copper Rolling Mill Products
Paragraph 148:
Gold Leaf. (See par. 146)
Paragraph 149:
Silver Leaf. (See par. 146)
Paragraph 167:
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Copper Alloys, Unmanufactured
Paragraph 461:
Copper Ore, Matte, and Cast Metal

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UNITED STATES TARIFF COMMISSION.

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PREFACE.

This is one of a series of Tariff Information Surveys prepared by the United States Tariff Commission and transmitted to the Committee on Ways and Means. The series covers all of the articles and commodities provided for in the tariff act of October 3, 1913, and others not specifically provided for. It is arranged in the numerical order of paragraphs of that act.

In some cases two or more paragraphs have been combined in one pamphlet. In doing this, industrial relationship of the articles has been followed when possible. In those instances where a paragraph has been treated under a preceding paragraph of the tariff act, reference is made to this fact at the point where the paragraph appears in numerical order. Where one grade of an article is dutiable and another grade of the same article is on the free list, the article is discussed under the dutiable paragraph, which appears first in numerical order in the tariff act. In certain instances articles of close industrial relationship and which occur in separate paragraphs of the tariff act have been combined under one paragraph for convenience of discussion. Reference is made to this fact at the point where the commodities would naturally occur in numerical order.

The first pamphlet in the series is an "Introduction and Index," which contains:

1. An introductory chapter discussing the scope of the series and the general method of treatment.
2. An alphabetical index of the articles provided for in the tariff act of 1913, showing the paragraph of the act in which the article is provided for and, if discussed under a different paragraph, the number of such paragraph.
3. A list of the pamphlets in the series, showing the paragraphs and articles included in each pamphlet.

Thus by use of this "Introduction and index," the exact location of the discussion relating to a given article or commodity can be ascertained.

In the preparation of this report the Tariff Commission had the services of Paul M. Tyler and S. L. Willis, of the Metals Division of the Commission's staff, and of others.

of the world market, since the largest refineries are located near that city. The shipment of foreign metal to the United States for refining strengthens the hold of domestic producers on the market control, since, after refining, it is sold through central selling agents organized by the domestic industry.

Copper metal, all forms, including secondary copper—Summary table.

Calendar Year.	Domestic production.	Imports for consumption.	Domestic exports.	Ratio to production.		Value (imports for consumption).	Value per unit of quantity (cents per pound).
				Imports.	Exports.		
	Pounds.	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*		
1910	1,269,159,509		[1] 708,316,543		55.8		
1911	1,311,232,749	267,101,810	[1] 786,553,208	20.4	60.0	$31,540,172	11.8
1912	1,518,268,720	304,956,415	[1] 775,000,658	20.1	51.0	44,211,579	14.5
1913	1,497,484,098	299,701,364	817,911,424	20.0	54.6	44,239,049	14.7
1914	1,405,901,192	200,512,738	748,902,137	14.3	53.3	27,705,764	13.8
1915	1,780,283,527	202,064,215	588,797,096	11.4	33.1	30,702,240	15.2
1916	2,627,850,548	286,618,713	735,695,406	10.9	28.0	65,244,879	22.7
1917	2,652,920,721	379,677,989	1,048,842,074	14.3	59.5	102,139,896	26.9
1918	2,657,565,595	410,933,416	704,973,117	15.5	26.5	97,602,771	23.7
1919	1,310,541,529	306,501,994	440,285,033	23.4	33.6	63,950,150	20.9
1920		364,389,855	553,647,405			67,238,057	18.5

[1] Includes the semimanufactured forms.

Production of copper in United States—Summary table.

Calendar Year.	Smelter production.	Secondary production.[1]	Total production.	Second.	Primary.
	Pounds.	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*
1910	1,080,159,509	189,000,000	1,269,159,509	14.9	85.1
1911	1,097,232,749	214,000,000	1,311,232,749	16.3	83.7
1912	1,243,268,720	275,000,000	1,518,268,720	18.1	81.9
1913	1,224,484,098	273,000,000	1,497,484,098	18.2	81.8
1914	1,150,137,192	255,764,000	1,405,901,192	18.2	81.8
1915	1,388,009,527	392,274,000	1,780,283,527	22.0	78.0
1916	1,927,850,548	700,000,000	2,627,850,548	26.6	73.4
1917	1,886,120,721	766,800,000	2,652,920,721	28.9	71.1
1918	1,908,533,595	749,032,000	2,657,565,595	28.2	71.8
1919	1,310,541,529				

[1] Includes all copper in secondary brass.

General Information.

PARAGRAPH 461, ACT OF 1913.

Old copper, fit only for remanufacture, clippings from new copper, and copper in plates, bars, ingots, or pigs, not manufactured or specially provided for in this section: Free.

DESCRIPTION.

Copper, the red metal, is surpassed only by gold and silver in malleability and by silver alone in its electrical conductivity. These properties make it, next to iron, the most useful of all metals.

The market grades are: (1) Blister copper, (2) casting copper, (3) electrolytic copper, (4) lake copper. Blister copper is seldom used in the trades, but is the usual product sold by smelters to the refineries. After refining it is classified as (2) or (3). Casting copper is fire-refined blister and scrap, which still contains impurities, but not enough to prevent its use for casting. It is rarely used in the electrical trade. Electrolytic copper is blister copper that has been refined by means of electricity. It is very pure, ranking with lake

copper for use in the electrical trade and in high-grade brasses. Lake copper is that obtained from the Michigan district. It is peculiar for its great purity as mined, especially its freedom from arsenic, which is objectionable in copper for electrical machinery, wires, etc.

Blister copper, together with the fire-concentrated ores of copper or mattes, are the most important products from a tariff standpoint.

USES.

The uses of copper are many, but the electrical industry is by far the largest consumer. It is particularly suitable for this because of its malleability, which permits its use as wire, and its high conductivity, which cuts down the installation cost, since small sizes may be used without undue losses of current.

Brass, bronzes, and other alloys chiefly used as bearing metals, piping, and for ornamental figures (plates, statues, etc.), are second in importance. A considerable amount of sheets, tubing, etc., is used outside the electrical industry.[1] Copper is extensively used in coinage, and in China it is the monetary medium of the working population.

The chief war use of copper is as brass in cartridge shells, and for this only high-grade metal (lake or electrolytic) is used.

TARIFF CLASSIFICATION.

In the tariff classification of copper (par. 461, act of 1913) the following products are classed with the metal on the free list: "Copper ore; regulus of, and black copper, and copper cement; old copper, fit only for remanufacture, copper scale, clippings from new copper, and copper in plates, bars, ingots, or pigs, not manufactured or specially provided for in this section."

Regulus of copper and black or coarse copper are fire concentrated products containing 40 to 85 per cent copper. They are intermediate forms only and are changed by smelting and refining to the commercial grades of the metal.

Copper cement is metallic copper obtained from copper-bearing solution by the addition of metallic iron. It is refined for the market by melting and casting or by electrolytic treatment.

Old copper, scale, and clippings are reclaimed metallic products fit only for remanufacture. Where the grade is known they are recast for the same uses as before, otherwise they are refined or used in bronzes, brass, etc., where impurities do not affect the product.

Copper plates, ingots, bars, and pigs are commercial shapes of the crude and refined metal.

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[1] Estimates of consumption for the year 1917 are:

	Pounds.
Wire	344,000,000
Rods	178,000,000
Sheets	153,000,000
Tubing	43,000,000
Casting	3,236,000
In brass (includes large amount of secondary copper)	722,500,000

These figures are abnormal in that war needs increased the amount of copper used in brass at the expense of the electrical trade.

All copper forms mentioned in paragraphs 147 and 114 are rolling mill products. They are usually intermediate products used in copper manufactures. Some sheet copper is used as such in the building trades and copper wire is to a large extent used for telephone and telegraph lines as well as in electric motors, etc.

COMPETING METALS.

Aluminum has been proposed as a substitute for copper in wire, since its lighter weight offsets to a great extent its greater cost and lack of strength. It may be said in general when aluminum is less than twice the price of copper it may be substituted for the latter metal to advantage in ordinary electrical work. In high-tension lines, however, the excessive expansion coefficient of aluminum causes trouble.

Sheet and cast copper is being largely replaced by zinc in the building trades because of the resistance of the latter metal in corrosion, its cheapness, and freedom from the fault of staining wood and stone surfaces.

DOMESTIC PRODUCTION.

The United States is, and has been since the early nineties, the world's largest copper producer. In fact, the domestic production is greater than that in all other countries of the world combined, and in 1917 amounted to 60 per cent of the total. This leadership will continue for some years, but will cease when certain large deposits now producing are exhausted, unless new ones are discovered before that time.

Domestic smelters and refineries treat large tonnages of ore from Canada, South America, and Spain and refine practically the entire Mexican and a large part of the South American metal production.

In 1918 domestic smelters reported production of 1,908,533,595 pounds, worth an average price of 24.62 cents per pound after refining.[1]

Raw materials.—Copper ores are naturally the principal source of metallic copper, but since copper is hard to destroy, large quantities are recovered in scrap, especially in brass. In certain districts the treatment of gold and silver ores in copper furnaces is often of great importance with those smelters which refine the crude copper electrolytically. In this process all the gold and silver values are recovered. These precious-metal ores often supply fluxing minerals necessary to the smelting process and greatly decrease the cost of production of copper. The use of these ores removes the necessity of mining and shipping barren flux, such as quartz, limestone, iron ore, etc.

A cheap source of fuel oil, coke, or coal is desirable for fuel. The blast-furnace plants use coke mixed with the ore and the horizontal or reverberatory furnaces use fuel oil or recently powdered coal for fuel.

Equipment.—The United States has led the world for years in copper metallurgy and equipment. In every phase of the treatment

[1] United States Geological Survey figures for domestic smelter production, exclusive of secondary metal, 705,340,000 pounds, and production from foreign ore of approximately 141,000,000 pounds.

from ore concentration to handling the refined product domestic methods and machines are far in advance of any foreign competition. Plant-erection costs in the United States are higher than abroad, but greater operating economy prevails, due to the larger units used. The smelting plants are not of themselves very expensive except where the concentrating plants and metal refineries are combined with the furnace unit. The life of a furnace is not very long, however, and the resulting depreciation makes large expenditures necessary for repairs and renewals. The installation of reverberatory in place of blast furnaces has cut down the unit cost of treatment. The reverberatory furnaces have a large capacity and a longer life than the blast type. The percentage recovery also is higher.

Method of production.—There are two distinct ores of copper, and two methods of smelting. The process depends largely on which ore is handled.

The ores from the Lake Superior district contain native copper free from impurities, and in smelters treating these ores the process is simple, as the blister copper produced does not have to be refined electrolytically. The melting is done in reverberatory furnaces. The bath of metal is poled with wooden rods to reduce the oxides present and then cast for the market.

This simplified practice is inexpensive compared to that necessary when sulphide ores are used, and the lower cost of the lake treatment makes the utilization of very low-grade ore profitable.

Sulphide ores require more complicated treatment. Large amounts of fluxes are necessary to slag off the iron and other minerals present, and the blister copper generally contains impurities, which require electrolytic refining for their removal. As noted above, gold and silver are recovered in the process of refining, and the precious-metal values go far toward paying the refining cost.

A brief outline of the more important phases of copper metallurgy has been prepared for the auxiliary file at the office of the Tariff Commission. The dominant features are high cost of plant, size of equipment, and efficient substitution of machine for common labor, especially as regards transportation of materials.

The labor used is exclusively adult male.

Capital invested and organization.—In 1914 there were $171,420,000 invested in plants smelting and refining copper. This was divided among 37 establishments employing 17,731 men. During the war there was considerable expansion, but since the armistice the industry has contracted to about the prewar figure.

The industry (both mining and smelting) is dominated by eight large financial groups, which together control practically all the domestic as well as a large part of the foreign production through ownership of mines, smelters, and refineries. The last factor is the most important, due to the large cost of plant. There are nine refineries in the United States [1] which handle all of the production, including lake copper.

[1] These refineries are owned by six groups, who in this way control practically the entire production.

Commercial control of copper mining and smelting in United States—Concluded.

	Pounds
Group 1.—Hayden-Jerome Porphyries affiliated with No. 2 Utah Copper Ray Consolidated, Nevada Consolidated, Chino, Butte and [illegible] [1] [illegible]	445, 887, 251
Group 2.—Kennecott-Braden, American Smelting & Refining Co., Kennecott and large number of small mines, control of which is maintained by leasing the product [1] [2] [5]	156, 954, 722
Group 3.—Porcupine-Ely, Anaconda, Inspiration, North Butte, Utah Consolidated, Montana Copper, Baltic, Lake, Walker Mine, Arizona Copper [1] [3] [5]	357, 306, 555
Group 4.—Phelps-Dodge and affiliations in Arizona and New Mexico, Copper Queen, Calumet and Arizona, Burro Hill, United Verde Ext., and Detroit Copper [2] [3]	275, 603, 113
Group 5.—Calumet and Hecla [2] [3] [5]	166, 765, 053
Group 6.—Other mine units not affiliated with 5 except to some extent through sales agency	99, 700, 000
Group 6.—U. S. Smelting, United Verde, Elm Orlu, Ophir Hill [2]	88, 390, 055
Group 7.—Independents, Miami and Shattuck Arizona, refined by 2 or 3 [2] [5]	57, 056, 666
Group 8.—U. S. Smelting, Refining & Mining Co., Utah Apex, Mammoth, Tintic, Carson Hill mines [2]	22, 600, 000

There is some copper produced outside these groups which, however, passes under their control in smelters and refineries.

From the above it is plain that the American Smelting & Refining Co. is a large factor in the copper as well as in the lead field. In fact, with its associates (two) it is the largest producer.

The finished product was formerly sold to some extent through German selling agents.[6] but since the war all the chief producers have organized selling organizations and some, through ownership of rolling, founding, and wire mills, control their product even further. Under the Webb-Pomerene law domestic producers are permitted to combine their export selling organization, and this new factor may prove an important influence in future export trade.

All of the large producing groups maintain efficient development forces under the best technical talent available, and this has resulted in the discovery of several valuable ore deposits in the United States, Alaska, and Chile.

Extent of German control.—The American Metal Co. was partly, and Beer-Sondheimer and L. Vogelstein wholly, under German ownership and control. These concerns acted as selling agents for some domestic copper and bought foreign and domestic metal outright for refining. The German interests were seized by the Alien Property Custodian and their control was broken as far as domestic copper is concerned. Certain Chilean and Mexican properties owned by these companies will probably continue under German control.

Geographical distribution.—There are four districts in the United States which produce practically all the domestic output of copper. Arizona, Montana, Michigan, and Utah and Nevada are the largest producing States, but California and Tennessee contain single large mines. The copper ore is always smelted at or near the mines and

[1] Commercial and Political Control of Copper Resources of the World, No. 18, United States Shipping Board.
[2] Own smelters.
[3] Own refineries.
[4] Own extensive interests in Mexico and South America.
[5] Control output through brass and wire mills.
[6] Merton & Co., Beer-Sondheimer, L. Vogelstein, American Metal Co.

shipped to the Atlantic seaboard for refining and sale.[1] In general the large freight toll on western metal is counterbalanced by the precious metal and large copper content of the ores used.

History of the industry.—The ore deposits of Michigan and Tennessee were no doubt worked by the Indians long before the discovery of America. Copper was first mined by white men in Connecticut (1709). Later mining was carried on in several of the Eastern States, but only in a small way. Copper was mined in California in 1860, but shortly before this time the Lake Superior deposits were opened up and Michigan soon became the leading producer. In 1887 Montana took the lead, only to lose it to Arizona after some years. Michigan is now third in importance.

Domestic production and consumption.—The United States has been for the last 40 years the world's largest copper producer. In peace years the domestic consumption is less than two-thirds the production and the large surplus is exported. Europe is our best customer. In common with that of the other base metals, the production of copper in the United States has shown a marked increase in recent years. In 1916 it reached 1,927,850,000 pounds.[2] This is probably the maximum possible output unless prices are even higher than during the war. The 1916 production was made under the stimulus of war, when profits were abnormally great, enabling high-cost mines to operate that would be idle in normal times. The production from now on should remain about stationary unless new discoveries or high prices act to increase the tonnage mined. The increase in production from year to year has been very irregular, depending on business and market conditions in the electrical and brass trades. The imports, though large, do not affect the market because of our large export surplus. Most of the foreign metal requires refining, following which it is, to a large extent, exported.

The tonnage of secondary copper is an important factor in the market and one which will grow in importance as the vast quantities of brass and copper which were used in cartridge cases, etc., are resmelted and reenter the trades.

Domestic exports.—Due to its preeminent position in the industry, the United States is the largest exporter of copper metal in the world. The total amount of metal exported is usually about half the total (primary and secondary) production, and is three times the amount of copper imported either as metal or as ore and matte. It is probable that the home markets from now on will consume a larger proportion of the production than before the war. If the United States acquires a considerable part of Germany's trade in electrical machinery, this will act to lower exports, since Germany was, before the war, this country's best customer. The substitution of other metals, especially aluminum, is another possible factor in the German situation.

Semimanufactured forms of copper, such as sheets, plates, tubes, bottoms, wire, etc., are becoming an important factor in our export trade. The manufacturing process is one requiring large units and powerful machinery, but only a small amount of labor per ton of product. The undeveloped nations buy more of these products than they do of the unmanufactured forms, but this country's largest customers

[1] Anaconda refines in Montana and ships refined metal.
[2] Smelter figures.

are the manufacturing nations—England, France, and Germany—which are also the largest buyers of ingot and pig copper. Apparently domestic rolling mills are able to meet the foreign producer in the home market. The products mentioned above are practically the only manufactures of copper entering into foreign trade.

FOREIGN PRODUCTION.

The most important foreign copper producers are Japan, Australasia, Chile, Canada, Peru, Germany, Mexico, and Spain. These countries account for over 25 per cent of the total supply. Germany, although a minor producer, ranks next to the United States as a consuming nation.

The copper production of foreign countries has been variously affected by the war. Japanese production has been enormously increased, as has that of South American countries. Canada, South Africa, and Australasia have suffered from labor shortage and the last two named from a greatly curtailed vessel tonnage available for overseas shipments. Political conditions caused a great decline in Mexico and Russia. Chile and Peru have had greatly increased production, due to American capital and energy, but the other South American countries have not developed any new mines or increased production in those already operating.

In the future Chile, Mexico, South Africa, and Canada should become large producers. They all have large virgin areas of promising territory and large known deposits. Russia has large deposits, for the most part undeveloped, but a stable government must be in control before foreign capital will be available to place that country in the producing class.

IMPORTS.

A large part of the copper imported is in the form of matte, ore, or blister copper, the smelting and refining of which is done at domestic refineries. This business amounted to 109,492,000 pounds of metal in ore and matte in 1913. Almost all of the 300,069,000 pounds of metallic copper imported in that year was blister copper which was refined here.[1] The crude ore and matte is all of foreign origin, as is also the blister copper, except for a small amount of Canadian metal smelted from domestic ore and returned for refining.

The small amounts of refined metal imported may be either of foreign or domestic origin. Some South American refined is sent to New York for sale and at times domestic copper that has been held abroad is shipped back to be resold.

The imports of crude copper and matte will increase, due to increased production in Mexico and South America.

REVENUE. The crude and refined metal unmanufactured are admitted free. The imports of copper manufactures are small compared to the total imports and the revenue from this source has never been over $65,000 in any calendar year. The bulk of dutiable imports are classed as "all other manufactures," as distinguished from the specific rate articles. The revenue from copper manufactures has been $5,000 since 1911.

[1] Mineral Resources U. S. Geological Survey.

TARIFF HISTORY.

In the tariff act of 1883 the metal paid a duty of 4 cents per pound. In 1890 the duty was cut to 1¼ cents per pound. In 1894 it was removed entirely. Since that date copper ores, matte, and unmanufactured metal have been on the free list.

COMPETITIVE CONDITIONS.

The control of the world's copper production as noted above under "organization" permits the domestic producers to set the price for the metal, subject to competition among themselves. This is furthered by ownership in foreign mines. While in some cases, notably in South America, production costs are lower than the average cost in the United States, the market price is governed by the cost to the large United States producers. This is natural because of the large domestic export surplus which Europe must have to meet domestic demands. The World War has greatly increased copper production costs, both at home and abroad. The increase has been general, however, so that comparative costs are considered practically the same as before 1914.

In 1918 the average cost of a pound of copper at New York to producers was $0.16167. The figures from the United States mining districts averaged $0.151 to $0.199. The average Canadian figure was slightly higher ($0.1626), while Mexico and South America were able to operate for slightly less ($0.156).[1]

Domestic production decreased rapidly during 1920 because of low prices and high mining costs. The present price of less than 14 cents per pound for electrolytic is below the cost of most producers. Foreign metal is not a factor.

Copper metal, smelter figures—Production in United States.

[From U. S. Geological Survey, Mineral Resources.]

States.	1910	1911	1912	1913	1914	1915
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Alaska	4,311,026	22,314,889	31,926,209	23,423,070	24,985,847	70,695,286
Arizona	297,250,538	303,202,532	359,322,096	404,278,809	382,449,922	432,467,690
California	45,760,200	35,835,651	31,516,471	32,492,265	29,784,173	37,658,444
Colorado	9,307,497	9,791,861	7,963,520	9,052,104	7,316,066	7,272,178
Idaho	6,877,515	4,514,116	7,182,185	8,711,490	5,875,205	6,217,728
Michigan	221,462,984	218,185,236	231,112,228	155,715,286	158,009,748	238,956,410
Missouri	.....	640,411	440,725	576,204	53,519	306,406
Montana	283,078,473	271,814,491	308,770,826	285,724,467	236,805,845	268,263,040
Nevada	64,494,640	65,561,015	83,413,900	85,209,536	60,122,904	67,757,322
New Mexico	3,784,609	2,860,400	29,170,400	50,196,881	64,204,703	62,817,234
North Carolina	181,263	13,699	63,766	180	19,712	33,383
Oregon	22,022	125,943	311,860	77,812	5,599	797,471
Pennsylvania	740,626	661,621	218,378	215,337	422,741	.....
Tennessee	16,691,777	18,965,143	18,395,256	19,489,654	18,661,112	18,205,308
Utah	125,185,455	142,340,215	132,150,052	148,057,450	160,589,660	175,177,695
Virginia	105,313	.....	96,753	46,961	17,753	50,008
Washington	65,021	195,503	1,069,938	732,742	683,602	903,661
Wyoming	217,127	130,499	25,080	362,235	17,082	351,871
All other	623,423	79,524	89,077	91,615	111,999	78,392
Total	1,080,159,509	1,097,232,749	1,243,268,720	1,224,484,098	1,150,137,192	1,388,009,527

[1] See Federal Trade Commission Report on Copper, 1918, in auxiliary file for details and expense distribution.

Total imports of copper, 1913 (copper contents)—Imports by countries.

Imported from—	Ores.	Matte regulus.	Old copper.	Pigs, ingots, etc.[1]	Composition metal.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Austria-Hungary			183,842	154	1,703
Belgium	98,342	32,147	130,918	1,020,441	
France		126,808	746,000	857,575	279,773
Spain	5,893,661	44,985		35,763,131	
Germany	113,800	450,051	883,479	187,256	1,171,654
Balkan States			112,000	5,299,267	
Great Britain	48,148	380,305	303,285	8,232,745	113,952
West Indies	6,337,729		1,203,546	8,889	19,969
Central America	1,265		232,381	516	12,588
Mexico	17,627,016	405,223	91,156	112,255,777	396
Canada	30,272,355	2,794,493	2,776,319	32,539,582	32,105
Newfoundland			37,005		15,321
Brazil			155,073		
Chile	14,096,944	13,436,913	35,763	13,968,645	
Argentina		167,804		200,538	
Ecuador				1,476	
Peru	2,707,485	7,930,376		40,219,590	
Venezuela			1,773		
Africa	3,215,575	629,111			
Asia		32,387	111,969	15,178,968	
Oceania		498,752	460	25,286,813	
All other			5,995	71,962	3,009
Total	80,412,320	26,929,355	7,010,964	291,093,325	1,650,470

[1] Germany, France, and England, chiefly refined metal. Balance largely blister and black copper.

Imports of copper, 1918 (copper contents)—Imports by countries.

Imported from—	Ore.	Concentrate.	Matte, regulus, cement, etc.	Blister converter.	Refined.[1]	Old and clippings.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
France			24,637	139,157		100
Italy			26,000			
England	112,384		784,130	112,738	109,412	292
Canada	31,861,999	57,094		43,367,845	2,610,592	5,223,224
Central America	23,245		29,014	2,180,525	900,151	226,112
Mexico	4,338,892	34,665,235	11,162,953	52,298,965	337,502	37,592
Newfoundland	59,869					21,744
Cuba and West Indies	33,172,655	3,877,440			128,770	647,457
Bolivia				264,552		
Argentina	44,605					
Chile	25,968,150		9,739,257	139,737,299	6,201,048	51,877
Colombia	919,373			3,122	1,872	22,990
Peru	2,921,794	31,312	578,169	88,170,631	3,754,771	46,035
Venezuela	3,460,674		321,487	1,875	1,109	91,991
Africa	1,808,163	462,000	203,949	13,709,991		
Asia (Japan)				1,180,480	689,868	110
Brazil						216,804
Oceania						5,339
All other						449
Total	104,691,803	39,093,081	22,869,596	341,167,180	14,735,095	6,592,116

[1] Includes 332,936 pounds composition metal.

Copper—Recapitulation of imports, 1913—Imports by countries.

	Pounds.
Copper ore	80,412,320
Matte and regulus	26,929,355
Old copper	7,010,964
Pigs, ingots, etc	291,093,325
Composition metal	1,650,470
Total	407,096,434

RECAPITULATION OF IMPORTS, 1918.

	Pounds.
Copper ore	104,691,803
Concentrates	39,093,081
Matte, regulus, and cement	22,869,596
Blister and converter	341,167,180
Refined copper and composition metal	14,735,095
Old and scrap	6,592,116
Total	529,148,871

Copper metal, crude, refined, and old—Imports of copper and manufactures of, for consumption.[1]

Calendar years.	Ore (free).		Concentrates (free).[2]		Matte, regulus, etc.	
	Pounds.	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*
1911	45,964,560	$4,707,578	.....	.....	21,158,841	$2,201,197
1912	81,232,986	8,996,527	.....	.....	23,256,855	3,461,142
1913	78,566,457	9,097,266	.....	.....	27,980,600	4,208,293
1914	81,408,306	9,164,508	.....	.....	19,410,198	2,513,948
1915	89,041,082	10,562,663	2,741,187	$409,865	18,645,589	2,663,681
1916	125,110,957	19,040,446	32,473,708	7,074,899	14,745,916	2,865,152
1917	114,112,282	19,207,412	40,329,198	9,292,963	18,183,176	4,246,978
1918	78,149,304	14,366,912	46,399,047	11,532,810	33,487,530	7,517,893
1919	50,888,436	9,804,282	37,173,757	6,993,722	42,650,214	7,938,933
1920	48,130,489	9,122,660	46,475,398	8,779,970	17,066,606	3,123,751

Calendar years.	Blister and converter.		Refined, ingots, pigs, etc.[3]		Old and scrap (free).	
	Pounds.	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*
1911	264,330,612	$31,267,496	.....	.....	2,771,198	$272,676
1912	298,826,080	43,445,542	.....	.....	6,130,335	766,037
1913	292,384,675	43,325,012	.....	.....	7,316,689	914,037
1914	195,724,885	27,145,985	.....	.....	4,787,853	559,779
1915	187,477,017	28,529,339	7,193,863	$1,213,581	7,393,335	959,320
1916	268,889,650	61,150,161	8,399,908	2,293,274	9,329,155	1,801,444
1917	355,167,716	95,491,873	6,632,885	1,978,068	17,877,388	4,669,955
1918	371,694,272	88,192,916	37,325,386	9,062,380	1,918,758	347,475
1919	267,128,474	55,310,001	35,156,180	7,996,380	4,217,340	643,769
1920	244,696,324	45,550,221	108,743,298	20,394,924	10,950,233	1,292,912

Calendar years.	Composition metal n. s. p. f.[4]		Plates, sheets, braziers, etc., 5 per cent.			Sheeting, 5 per cent.		
	Pounds.	*Value.*	*Pounds.*	*Value.*	*Duty.*	*Pounds.*	*Value.*	*Duty.*
1911	.....	.....	56,751	$12,038	$1,418.82	15,051	$2,722	$301.02
1912	.....	.....	46,239	11,796	1,156.01	.....	.....	.....
1913	530,438	$85,881	238,681	36,580	1,537.86	25,416	3,591	.....
1914	658,503	107,762	298,075	62,176	2,711.35	20,612	3,420	40.65
1915	169,270	22,242	18,314	4,989	249.45	.....	.....	.....
1916	631,231	122,849	53,051	16,389	819.45	118	59	2.95
1917	486,916	103,431	222,642	81,446	4,072.30	298	43	1.72
1918	208,170	44,253	547	269	13.45	.....	.....	.....
1919	355,982	64,028	11,248	5,331	266.55	.....	.....	.....
1920	4,235,647	518,171	10,451	4,070	203.50	.....	.....	.....

Calendar years.	Wire and manufactures of, 15 per cent.		All other manufactures of, 20 per cent.		Total.		
	Value.	*Duty.*	*Value.*	*Duty.*	*Free value.*	*Dutiable value.*	*Duty.*
1911	$1,667	$630.95	$33,475.72	$15,064.06	$38,448,947	$49,903	$17,414.85
1912	5,509	2,439.93	38,417.28	17,287.78	56,669,248	55,722	20,883.72
1913	4,417	1,756.16	106,522.27	39,421.69	57,630,489	151,110	42,715.71
1914	6,683	999.45	100,556.50	19,285.10	39,491,982	172,836	23,036.55
1915	2,405	360.75	29,941.00	5,988.20	44,360,691	37,335	6,598.40
1916	71,300	10,695.00	60,485.00	12,096.92	94,348,225	148,233	23,614.32
1917	101,947	15,292.05	68,737.00	13,743.40	134,990,680	252,173	33,109.47
1918	20,006	3,000.90	53,188.00	10,637.60	131,064,639	73,463	13,651.95
1919	42,044	6,306.60	61,355.00	12,271.00	88,751,115	108,730	18,844.15
1920	67,711	10,156.65	232,366.00	46,473.20	88,782,609	304,147	56,833.35

[1] Figures compiled from Commerce and Navigation.
[2] Included under ore prior to July 1, 1915.
[3] Included under blister, etc., prior to July 1, 1915.
[4] Included under pigs, blister, and converter copper prior to 1913.

Copper metal—Domestic exports (fiscal years).

Exported to—	1910	1911	1912
	Pounds.	*Pounds.*	*Pounds.*
Austria-Hungary	35,507,421	39,802,873	44,139,621
Belgium	6,897,582	6,202,125	5,148,059
Denmark [1]	191,139	505,773	549,756
France	93,693,862	131,945,329	154,280,207
Germany	144,037,695	193,208,703	217,869,953
Italy	26,959,740	38,501,159	44,654,247
Netherlands [1]	184,970,049	244,285,109	193,398,429
Russia	3,373,822	12,197,930	10,431,586
Sweden	1,637,209	5,101,556	8,733,963
United Kingdom	135,065,248	111,708,012	104,422,847
Canada	6,524,481	6,420,527	18,661,127
Central America	215,538	227,845	1,006,077
Mexico	118,241	313,077	238,982
West Indies	38,523	101,677	66,451
South America	20,889	275,688	91,485
Asia	3,243	4,000	1,023,751
Oceania	5,712	60,000	53,400
Africa	2,000	14,865	.....
Turkey in Europe	112,003	1,119,435	426,658
All other	.....	55,481	89,802
Total	639,374,397	792,051,164	805,286,401

[1] Nearly all of this metal is for German consumption.

Copper—Pigs, ingots, and bars; includes black and blister—Domestic exports (fiscal years).

Exported to—	1913	1914	1915	1916 [1]	1917 [1]	1918 [1]
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Austria-Hungary	36,584,405	42,029,801	2,984,987	.....	.....	.....
Belgium	7,834,225	8,155,160	752,555	.....	.....	.....
France	119,774,235	163,586,230	144,209,413	78,493	941,777	3,932,967
Denmark	641,773	651,285	6,097,396	.....	.....	.....
Germany	249,876,514	274,065,914	20,811,321	.....	.....	.....
Italy	43,885,517	45,132,555	88,874,742	3,194,402	9,064,323	21,093,995
Netherlands	159,646,931	162,983,424	29,257,197	354,164	224,415	.....
Portugal and Spain	98,648	23,708	499,653	.....	.....	.....
Russia	5,870,877	9,394,980	16,749,206	.....	.....	.....
Turkey	218,276	694,348	.....	.....	.....	.....
Sweden and Norway	9,080,914	16,005,094	45,061,001	.....	.....	.....
Great Britain	101,637,820	134,778,613	215,602,954	1,031,749	7,778,778	1,509,016
Canada	4,513,350	3,594,877	6,379,277	262,281	190,517	11,480
Mexico	395,594	21,987	105,230	.....	1,087	2,068
Central America	261,818	55,779	4,894	.....	.....	.....
South America	12,517	168,994	1,504,722	.....	.....	500
West Indies	5,657	3,092	24,978	.....	.....	.....
Oceania	781	536	107,870	.....	.....	.....
All other	460	3,256,344	2,846,141	.....	.....	.....
Total	740,340,312	864,602,721	581,873,537	4,921,089	18,200,897	26,550,056

[1] Years 1916–1918 unrefined copper only.

Copper, refined, in ingots, bars, and other forms—Domestic exports (fiscal years).

Exported to—	1916	1917	1918
	Pounds.	*Pounds.*	*Pounds.*
Denmark	4,962,580	7,251,814	461,325
France	297,557,591	352,017,699	333,190,164
Italy	90,428,144	134,743,931	127,295,032
Netherlands	1,062,586	1,659,364	144,227
Norway and Sweden	31,489,591	9,750,186	367,419
Spain and Portugal	416,869	849,669	1,153,518
Russia	24,412,481	87,512,161	29,488,436
Switzerland	1,575,298	879,375	3,752,285
Great Britain	153,745,532	282,851,193	311,744,966
Canada	30,683,790	55,194,962	27,236,583
Central America	9,775	16,032	59,297
Mexico	55,661	9,721	233,957
South America	157,042	749,871	918,394
Asia	20,211,616	3,710,013	203,083
Africa	26,149	17,287	76,858
Oceania	16,713	145,265	62,916
West Indies	493,849	61,078	1,314,169
All other	586,342	682,547	75,942
Total	657,891,609	938,102,168	837,778,571

Copper, old and scrap [1]—Domestic exports (fiscal years).

Exported to—	1913	1914	1915	1916	1917	1918
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Belgium		11,998				
France	66,507	46,313	1,526,598		144,816	
Germany	545,622	1,709,720	232,014			
Italy		229,227	1,078,772		1,085,403	164,012
Netherlands	113,935	316,679	523,377			
Norway and Sweden			2,071,810			
Spain and Portugal			52,066			
England	1,623,887	3,174,904	2,055,387	225,943	31,864	
Canada	325,776	324,506	106,777	73,292	247,246	277,365
Central America	130	2,235	1,261		44	500
Mexico	195	6,000	2,123		1,103	
West Indies	3,362	5,409	19,154	2,033		
South America	2,622	2,710				3,240
Asia				11,316		
Oceania						1,299
Africa						438
All other		284				
Total	2,682,036	5,829,985	7,669,339	312,584	1,510,476	446,854

[1] Contained in bars, pigs, etc., prior to 1913.

Copper metal—Distribution of exports—Domestic exports, fiscal year 1918.

Exported to—	Ore, matte, regulus.	Old and scrap.	Plates and sheets.	Pigs, ingots, bars, etc.	Rods and wire.
	Long tons.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Austria-Hungary	.....	.....	537,700	36,584,405	.....
Belgium	.....	.....	286,731	7,834,225	13,444
France	19	66,507	9,772,414	119,774,235	20,896
Denmark	.....	.....	.....	641,773	.....
Germany	19	545,622	29,527,933	249,876,514	980,017
Italy	.....	.....	11,816	43,885,517	.....
Netherlands	.....	113,935	13,388,894	159,646,931	1,626,424
Norway and Sweden	.....	.....	44,852	9,080,914	.....
Russia	.....	.....	.....	5,870,877	.....
Spain and Portugal	.....	.....	.....	98,648	16,829
Great Britain	154	1,623,887	2,964,911	101,637,820	5,356,703
Canada	13,349	325,776	4,145,663	4,513,350	28,657,865
West Indies	.....	3,362	46,518	5,657	1,166,380
Central America	.....	130	188,636	261,818	360,118
Mexico	50,800	195	38,086	395,594	612,753
South America	.....	2,622	35,735	12,517	2,134,853
Asia	.....	.....	1,118	.....	56,408
Oceania	.....	.....	59,131	781	410,750
Africa	.....	.....	.....	.....	27,395
All other	.....	.....	.....	218,736	19,066
Total	64,341	2,682,036	61,050,138	740,340,312	41,459,901

Copper—Distribution of exports, in pounds—Domestic exports, fiscal year 1918.[1]

Exported to—	Ore.	Matte, regulus, concentrates.	Unrefined black and converted copper.	Refined in bars, etc.	Composition, metal, copper. Ch. Val.	Old and scrap.
France	.....	.....	3,932,967	333,190,164	1,120,231	.....
Italy	.....	.....	21,093,995	127,295,032	.....	164,012
Denmark	.....	.....	.....	461,325	.....	.....
Netherlands	.....	.....	.....	144,227	.....	.....
Norway and Sweden	.....	.....	.....	367,419	.....	.....
Spain and Portugal	.....	.....	.....	1,153,518	.....	.....
Russia	.....	.....	.....	29,488,436	.....	.....
Switzerland	.....	.....	.....	3,752,285	.....	.....
Great Britain	.....	.....	1,509,016	311,744,966	.....	.....
Canada	3,921,923	873,693	11,480	27,236,583	117,837	277,365
Mexico	.....	.....	2,068	233,957	23	.....
West Indies and Central America	.....	.....	.....	1,373,466	1,500	500
South America	.....	.....	500	918,394	20,144	3,240
Asia	.....	.....	.....	203,083	1,371	.....
Africa	.....	.....	.....	76,858	8,935	438
Oceania	.....	.....	.....	62,916	45,445	1,299
All other	.....	.....	.....	75,942	.....	.....
Total	3,921,923	873,693	26,550,026	837,778,571	1,315,486	446,854

Exported to—	Pipes and tubes.[2]	Plates and sheets.	Wire not insulated.
France	1,879,225	6,147,726	5,668,228
Denmark	2,600	4,048	400,819
Italy	1,051,143	7,525,350	2,328,772
Netherlands	19,601	52,862	454,358
Norway and Sweden	38,211	28,991	182,863
Spain and Portugal	108,503	178,609	2,383,664
Switzerland	.....	19,183	427,536
Great Britain	3,324,181	19,005,025	2,358,387
Canada	695,844	1,469,223	478,605
Mexico	9,653	43,171	213,298
Central America and West Indies	1,587,362	554,485	346,866
South America	309,301	1,541,237	2,240,969
Asia	290,820	92,131	216,107
Africa	38,123	153,741	363,478
Oceania	209,796	609,164	474,290
All other	1,141	2,679	48,083
Total	9,565,504	37,427,625	18,586,323

[1] Figures from Commerce and Navigation.
[2] Pipes and tubes not separate before 1918. Figures from Commerce and Navigation.

Copper—Recapitulation of exports for 1913 and 1918—Domestic exports (fiscal years).

	Pounds.
1913—	
Ore, matte, regulus, 64,341 tons	[1] 257,364
Old and scrap	2,682,036
Plates and sheets	61,050,138
Pigs, ingots, etc	740,340,312
Rods and wire	41,459,901
Total	845,789,751
1918—	
Ore	3,921,923
Matte, etc	873,693
Unrefined metal	26,550,026
Refined bars, etc	837,778,571
Composition metal	1,315,486
Old scrap	446,854
Pipes, etc	9,565,504
Plates and sheets	37,427,625
Wire, etc	18,586,323
Total	936,466,005

Electrolytic copper—Prices in New York in cents per pound.

[From Mineral Industry.]

Months.	1910	1911	1912	1913	1914	1915	1916	1917
January	13.620	12.295	14.094	16.488	14.223	13.641	24.008	28.673
February	13.332	12.256	14.084	14.971	14.491	14.394	26.440	31.750
March	13.255	12.139	14.698	14.713	14.131	14.787	26.310	31.481
April	12.733	12.019	15.741	15.291	14.211	16.818	27.895	27.935
May	12.550	11.989	16.031	15.436	13.996	18.506	28.625	28.788
June	12.404	12.385	17.234	14.672	13.608	19.477	26.601	29.962
July	12.215	12.463	17.190	14.192	13.223	18.796	23.865	26.620
August	12.490	13.405	17.498	15.400	(a)	16.941	26.120	25.380
September	12.379	12.201	17.508	16.328	(a)	17.502	26.855	25.073
October	12.553	12.189	17.314	16.337	(a)	17.686	27.193	23.500
November	12.742	12.616	17.326	15.182	11.739	18.627	30.625	23.500
December	12.581	13.552	17.376	14.224	12.801	20.133	31.890	23.500
Average	12.738	12.376	16.341	15.269	13.602	17.275	27.202	27.180

Months.	1918	1919	1920
January	23.500	(b)	.....
February	23.500	16.763	.....
March	23.500	14.856	.....
April	23.500	15.246	.....
May	23.500	15.864	.....
June	23.500	17.610	.....
July	25.904	21.604	.....
August	26.000	22.319	.....
September	26.000	21.755	.....
October	26.000	21.534	.....
November	26.000	19.758	.....
December	(b)	18.295	14.00
Average	24.628	18.691	[c] 16.00

[a] No quotations. [b] No market. [c] Approximately. [1] Estimated.

Copper—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883	186	* * * Old copper, fit only for remanufacture, clippings from new copper, and all composition metal of which copper is a component material of chief value not specially enumerated or provided for in this act.	3 cents per pound.
1890	192	.....do.....	1 cent per pound.
1894	452	.....do.....	Free.
1897	533	.....do.....	Do.
1909	544	* * * Old copper, fit only for remanufacture, clippings from new copper.	Do.
1909	545	Composition metal of which copper is the component material of chief value, not specially provided for in this section.	Do.
1913	461	Old copper, fit only for remanufacture, copper scale, clippings from new copper.	Do.
1913	460	Composition metal of which copper is the component material of chief value, not specially provided for in this section.	Do.
1883	186	* * * Copper in plates, bars, ingots, Chile or other pigs, and in other forms, not manufactured or enumerated in this act.	4 cents per pound.
1890	194	Copper in plates, bars, ingots, Chile or other pigs, and in other forms, not manufactured, not specially provided for in this act.	1½ cents per pound.
1894	454	Copper in plates, bars, ingots, or pigs, and other forms, not manufactured, not specially provided for in this act.	Free.
1897	532	.....do.....	Do.
1909	544	* * * Copper in plates, bars, ingots, or pigs, not manufactured or specially provided for in this section.	Do.
1913	461	Copper in plates, bars, ingots, or pigs, not manufactured or specially provided for in this section.	Do.

BRASS AND OTHER COPPER ALLOYS IN WHICH COPPER IS THE METAL OF CHIEF VALUE, UNMANUFACTURED.

SUMMARY.

Alloys containing copper as a metal of chief value include two of the most important commercial alloys; namely, brass and bronze. These are used in larger amounts than is the parent metal, copper. Brass is an alloy composed of copper and zinc in which the copper content varies from 35 to 95 per cent. Bronze is composed of copper and tin, the percentage of copper ranging from 75 to 95. Other alloys, mainly modifications of brass and bronze, contain small amounts of other metals such as iron, aluminum, manganese, nickel, or lead. The minor constituents impart certain properties to the finished product which greatly widen its utility.

Copper alloys are widely used in the trades for bearing metals, pipe, rods, tubes, sheet, wire, electrical fixtures, and builders' hardware.

DOMESTIC PRODUCTION.

There is more than enough brass produced in the United States to supply the domestic demand, but normally little crude is exported because of the restricted market for these alloys in the crude form. Scrap brass and bronze are important sources of the alloys. The alloys used in the casting industry are practically always mixed at the foundry, thus saving the expense and zinc loss incident to a second melt from the ingot. The products from this branch of the industry, with the exception of pipe fittings, do not enter international trade to any extent. Bearing metals are mixed at the foundry and then shipped to the consumer in the ingot form. Railroads and other large consumers mix their own bearing metals.

The capital outlay necessary for a plant making brass or bronze is small, but the rolling and wire mills, which consume a large part of the alloys, require large expensive installations of powerful machinery. This branch of the industry is concentrated in the northeastern United States with scattered plants westward to Chicago.

Exports of brass and bronze rolling and wire mill products are increasing in amount. The war created a large market for sheet and similar products in England and France.

FOREIGN PRODUCTION.

Great Britain, Germany, and France are normally large producers of brass. The exports of ingot metal from these countries is small, but large tonnages of finished products enter international trade.

Imports of brass or of brass products are very small. Scrap brass and bronze from Canada, Mexico, Cuba, Brazil, and other undeveloped countries are the most important items on the list. During the last 10 years, exports of copper alloys have always been far in excess of the imports.

COMPETITIVE CONDITIONS.

The domestic industry is in an advantageous position as regards the supply of copper—the most important item—although this metal is obtainable in Europe at only slightly higher prices than those which prevail in the United States in spite of the fact that this country furnishes the bulk of the supply. The price of zinc is ordinarily a little higher in the United States than in other large consuming countries and imports of foreign metal must pay duty. Supplies of tin are obtainable in this country at about the same price as in Europe. It would seem, therefore, that under normal conditions the American brass industry is practically on an even footing with its foreign competitors as regards its raw materials. Since the war, the accumulation of brass scrap has been a factor favoring European foundries, but this has been, to a large extent at least, offset by higher fuel costs abroad.

The strength of the European industry in world trade is largely attributable to the location of the plants at or near seaboard, enabling the cheap assembly of raw materials and the shipment of products by water.

TARIFF CONSIDERATIONS.

All of the unmanufactured copper alloys, with the exception of German silver, are on the free list either as scrap brass or as composition metal in which copper is the metal of chief value.

A revision of the tariff paragraphs covering the manufactured forms of copper alloys is advisable. Sheet, tubes, plate, and wire should be treated specifically. They are manufactured in large quantities and are more important than similar manufactures of copper. Sheet brass as sheathing should be removed from paragraph 147, because sheathing no longer competes with copper to any extent, and a division of brass sheets between two paragraphs involves confusion and litigation.

Old and scrap brass and composition metal [1]*—Summary table.*

Fiscal year.	Entire domestic production of brass.	Imports for consumption.[2]	Domestic exports.[2]	Ratio of imports to exports.	Value (imports for consumption).[2]	Amount of duty.	Value per unit of quantity.
	Value.	*Pounds.*	*Pounds.*	*Per cent.*			
1910		6,501,705			$798,767.50	Free	$0.123
1911[3]		4,087,315			523,476.00	...do	.128
1912		4,065,226	37,677,296	10.8	437,811.00	...do	.108
1913		8,750,958	19,694,817	39.3	893,224.50	...do	.102
1914	[4] $131,503,724	7,220,296	25,738,845	28.1	765,319.38	...do	.106
1915		7,594,532	15,766,007	43.8	664,753.00	...do	.088
1916		34,753,588	5,162,293	673.0	4,501,510.00	...do	.130
	Pounds.						
1917	[4] 1,072,508,000	53,307,225	10,240,279	520.0	8,737,010.00	...do	.164
1918		32,731,025	4,495,222	728.0	5,643,382.00	...do	.172
1918[5]		12,228,988	4,909,820	249.0	1,773,789.00	...do	.145
1919[5]		15,865,946	1,321,767	1,200.0	2,157,043.00	...do	.136
1920[5]		45,363,942	2,060,468	2,201.6	5,244,715.00	...do	.116

[1] Little or no new crude metal is imported or exported.
[2] Department of Commerce, Commerce and Navigation Statistics.
[3] Census of Manufactures, 1914.
[4] War Industries Board Price Bulletin No. 34.
[5] Calendar year.

General Information.

TARIFF PARAGRAPHS, TARIFF ACT OF 1913.

Par. 430: Brass, old brass, clippings from new brass or Dutch metal, all the foregoing, fit only for remanufacture, free.

Par. 460: Composition metal of which copper is the component metal of chief value n. s. p. f., free.

Par. 413: Bells, broken, and bell metal, broken, and fit only to be remanufactured, free.

DESCRIPTION.

The commercial alloys of copper included under these paragraphs fall in three large groups: (1) Brasses, (2) bronzes, (3) miscellaneous. They are together of more importance in the trade than the parent metal, copper, because they are harder, stronger, and therefore better adapted to general use.

Brass and bronze composition and properties.[1]

Name.	Composition.					Properties.
	Cu.	Zn.	Fe.	Sn.	Pb.	
Aich's metal	60	38.12	1.5	.....	.....	Great tensile strength, 85,000 pounds per square inch.
Acid-resisting metal	83.05	6.0	.....	10.81	0.10	Acid resisting, noncorrosive.
Ajax plastic bronze	65.00	.....	.....	5.00	30.0	
Admiralty brass	61.7	36.9	.....	1.4	.....	Melts at 1,570° F.
Bell metal	80.0	20.00	.....	.....	.....	
Cartridge brass	66.66	33.34	.....	.....	.....	Plumbers' brass may carry lead.
High brass	61.50	38.50	.....	.....	.....	Typical brass; high naval brass may carry 1 per cent tin.
Low brass	80.00	20.00	.....	.....	.....	
Brass solder	50.00	50.00	.....	.....	.....	May carry 33 per cent Cu and 67 per cent Zn.
Bronze, coinage	95.0	1.0	.....	4.0	.....	
Bronze, bearing	80.0	7.0	.....	13.00	.....	
Do	90.0	7.0	.....	3.0	.....	
Bronze, United States naval	88.0	2.0	.....	10.0	.....	
Bronze, English gear	88.7	.....	.....	11.0	.....	Carries phosphorus, 0.30 per cent.
Bronze, Tobin	58.22	39.48	.....	2.30	.....	
Camelia metal	70.20	10.20	.55	4.25	14.78	
Delta metal	55.1	43.47	1.08	.....	.37	
Gun metal	87.75	2.50	.....	9.75	.....	
Hydraulic bronze	75.0	14.0	.....	11.0	.....	
Manganin	82.12	.....	.57	.....	.....	Ni, 2.29, manganese, 15.02.
Tombac	86.38	13.61	.....	.....	.....	
Muntz metal	62.0	38.0	.....	.....	.....	
Manganese bronze	88.6	1.57	.72	8.70	.295	Trace of phosphorus.
Pinchbeck	83.33	16.76	.....	.....	.....	
Phosphor bronze	80.0	.....	.....	10.0	10.0	Phosphorus, 0.05–0.25.
Sterro metal	55.33	41.8	4.66	.....	.....	
Biak metal	.....	.....	.....	.....	.....	New metal of great strength.

[1] Liddell: Metallurgical and Chemical Handbook.

(1) Brass is the name given to any alloy composed of copper and zinc as metals of chief value. The copper content varies from 35 per cent to 95 per cent depending on the variety of alloy desired. The color is reddish in the high copper brasses, fading to white in those containing 50 per cent or more of zinc.

(2) Bronze is an alloy of copper in which copper and tin are the metals of chief value. Recently alloys of copper with manganese and aluminum have been termed bronzes, and the definition should be broadened to cover these products. The percentage limits of copper in ordinary bronzes are much narrower than in brasses. Excluding bell metal, which may contain upward of 30 per cent tin, the commercial bronzes contain not less than 80 per cent copper or more than 20 per cent of tin. Small amounts of other metals are added at times to improve the product, and the bronze produced is often known by the name of the minor constituent, e. g., phosphor bronze. Bronzes are reddish to yellow, depending on the percentage of copper contained.

(3) There are a large number of alloys of varying composition but in chief value of copper used for special purposes, chiefly as bearing metals and where heat resistance and high tensile strength is desired. These, when in the unmanufactured state, are admitted as composition metal. Some copper-aluminum, copper-manganese, copper-nickel, and copper-magnesium alloys as well as the cheaper grades of German silver fall in this class. The last named alloy is specially provided for, however.

In general it can be said that copper alloys are harder than copper and of higher tensile strength than the pure metal. The ordinary

brasses and bronzes can be rolled and drawn, but the malleability and ductility decrease with increased percentages of zinc or tin. Heat treatment affects the physical properties to some extent. Under some conditions it may soften and in others toughen the alloy.

USES.

Brasses and bronzes find large use in the trades as bearing metals and parts in heavy and light machinery. They are cast for ornamental use as statues, name and memorial plates, etc., and are used extensively in the higher class of builders hardware, such as locks, wood screws, hinges, door plates, and guard rails.

Next to iron and steel, brass is the most important metal used in the pipe and tube industry. Practically all the exposed plumbing fixtures in dwelling houses are composed of brass as are also the pipes and oil cups on most light engines. Brass tubing, with or without an iron core is used for all railings and bright metal trim on board vessels, especially naval craft and those engaged in passenger traffic. Thin brass tubing, usually supported by an iron core, is used extensively for bedstead frames. Heavy copper alloy tubes are used in place of steel for marine boiler tubes.

Brass and bronze wire is used to a large extent in the electrical industry, where tensile strength is of more importance than electrical conductivity, and for wire guards, frames, and screen.

Brass wire and sheet is the base of most cheap jewelry.

The chief war use for brass and bronze is for cartridge shells. In former times bronze was used exclusively for cannon, but alloy steels have replaced it for this use entirely.

Several brasses and bronzes have been given special trade names, e. g., Dutch metal, Yellow metal, Tobin bronze, Admiralty metal, etc. From a tariff standpoint the divisions are superfluous, since there is nothing in the manufacturing process which justifies the separation other than the percentage of copper, zinc, and tin used. The table on page 43 gives the average composition and properties of typical brasses and bronzes.

DOMESTIC PRODUCTION.

The consumption of bronze and brass is greater than that of any other metal except iron and steel. Most of the secondary copper is recovered in the form of brass and then is returned direct to the trade after melting and casting. In 1917 almost 25 per cent of the new copper was consumed in the brass industry.[1]

Materials.—The raw materials used in the manufacture of copper alloys are copper (usually pure, but may be impure for casting), zinc, tin, phosphorus, iron, nickel, aluminum, lead, and manganese. The last six metals are used in very small amounts compared with the three principals, but often they affect the resulting alloy to an extent far beyond that indicated by the percentage composition.

Scrap and old metal is an important source of the alloys. The brass recovered from scrap, both new and old, has steadily increased until at present fully half the brass production is obtained from these

[1] War Industries Board Price Bulletin No. 34.

sources. Mixed scrap of unknown composition is used in castings, but when the grade is known it is remelted and cast for products similar to its primary forms.

Equipment.—The equipment necessary for manufacturing copper alloys is small unless the rolling and wire mills are included under this classification. A coal, oil, gas, or electric furnace is necessary, of sufficient size to hold the crucibles containing the melt of alloy. The mixing furnaces are always operated in connection with the foundry as it is more economical to pour the castings at the plant where the alloy is made, thus saving the expense and loss of zinc incident to a second melt.

Reverberatory furnaces are used for melting bundled scrap and ingot brass, but the crucible furnaces predominate. The year 1919 was characterized by a widespread introduction of electric melting furnaces in place of melting in crucibles or in open combustion furnaces. Fifty or more electric furnaces were erected in a single brass-making city (Bridgeport, Conn.), and other brass makers in the country are either looking on with interest or have already determined to follow suit.

Methods of production.—The copper is first heated to a little above its melting point under a cover of charcoal and then the zinc or other metal (previously heated to near its melting point) is added slowly, so as not to chill the mix. Finally the deoxidizing metal (phosphorus or aluminum) is added as desired, and the alloy is poured into molds. The plates, bars, and rods produced are the raw materials used in the wire, plate, and sheet mills. Machinery castings are poured in the regular way, and after being cleaned are machined for the trade.

Organization.—That part of the founding industry supplying the wire, sheet, and pipe mills is in the hands of a small number of large corporations. This is due to the large investment required and to the wide market required for economical operation.

That part of the casting industry devoted to the manufacture of gear blanks and pipe fittings is generally in large units because the articles are standardized and can be manufactured in large central plants and shipped to consuming centers.

The custom casting industry is in the hands of a large number of small operators. Except as mentioned above, there is no advantage in large scale production that is not nullified by the inconvenience to the consumer of waiting for shipments from distant points. Special machinery castings requiring intricate patterns and quick deliveries are an important factor in the business. The market and demand for this class of material is necessarily limited in any one district, and this necessitates the operation of small plants in every trade center. The industry is operated to some extent by the iron foundries, especially in small towns. In cities and large manufacturing centers, however, there are foundries producing nonferrous alloy castings exclusively.

The manufacture of brass and other copper alloys is so closely connected with that of other metals that no accurate estimate can be made of the capital involved. It is very large, however.

Geographical distribution.—That part of the brass and bronze industry connected with the wire and rolling mills is located in close proximity to those plants. This business as well as the pipe fitting

and gear blank foundries are concentrated in northeastern United States with scattered plants westward to Chicago. Connecticut, New York and New Jersey are the chief producers.

As mentioned, above, the balance of the casting industry is conducted in small plants located in all parts of the country. The central and eastern part of the United States produces more of this material than does the South and West, but this is caused by the fact that consumers are located there, and not because raw materials are less expensive, or that labor is more easily obtainable.

History of the industry.—Bronze was known to the ancients. Brass and bronze were obtained from mixed zinc or tin, and copper ores, by direct smelting, and it was centuries before the alloys were known to consist of more than one metal.

Brass and bronze have been cast in the United States since colonial times, but the large wire and rolling industry is an outgrowth of the enormous domestic copper supply, which gives the domestic manufacturer an advantage, not only in the domestic, but in the foreign markets as well.

Domestic production and consumption.—The domestic industry produces practically the entire domestic supply of copper rich alloys, and in addition, manufactures a small tonnage for export. The crude alloy does not figure in international trade except as scrap. In 1914 the value of brass and bronze products produced was $131,503,724. About 26 millions of this was in plates and sheets; almost 16 millions in ingots, rolled bars and rods; 10 millions in tubing and pipe; almost 6 millions in wire; and the balance (about 74 millions) in other manufactured products such as castings, pipe fittings, machinery parts and articles manufactured from the semi-finished forms enumerated above.[1]

In 1914 there were 904 establishments in the United States producing brass and bronze.

Domestic exports.—Brass or other copper alloys in the ingot or pig form is a very minor item in our export trade. The exports of scrap, as well as finished and semifinished products, on the other hand, are quite large. During the fiscal year 1910 the total value of brass exports was $4,355,561. This was largely composed of old and scrap brass. In 1914 the exports of scrap brass were $2,714,202, and in addition there were exported $3,966,645 worth of manufactures. In 1918, due largely to war demands, the value of exports was much larger. In that year there were exported: Scrap valued at $900,000; plates and sheets, $2,900,000; pipes, etc., $4,000,000; cartridge shells, $800,000; wire, $1,200,000, and other manufactures valued at $25,000,000. As the European nations resume their normal production, the domestic exports will no doubt suffer a considerable decrease.

In 1914, the last normal fiscal year, Germany was the largest buyer of domestic scrap brass. Canada was practically the only buyer of plates and sheets, and the most important customer for manufactured products. The exports of manufactures including wire, pipe, tubes, sheet, etc., went to practically every country on the globe, but in very small amounts. England and Germany were next to Canada, our best customers.

[1] Census of Manufactures, 1914.

FOREIGN PRODUCTION.

Germany, Great Britain, and France are normally the largest foreign producers of copper alloys. The rolling and wire mill industries abroad are well organized and the production is sufficient to supply the home market and provide large tonnages for export. Some of this material enters the United States but the tonnage is small. In Europe, as in the United States, the custom cast-brass industry is a local affair.

IMPORTS.

The imports of copper alloys in the unmanufactured forms are confined to scrap brass and bronze and small quantities of special brasses and bronzes for bearing metal use. The tonnage is small, but may increase to some extent as the scrap war material reenters the market. Our exports of the finished products even to the manufacturing nations of Europe is far in excess of the imports from those nations.

PRICES.

Prices of brass and bronze depend on the cost and percentage of the component metals used, rather than on the cost of mixing. It is, therefore, useless to give quotations without specifying the exact composition. The matter is complicated further by the fact that very little brass or other alloy enters the market in the form of ingots or pigs, except material of special composition for bearing metals. Naturally the price of sheets, pipes, tubes, etc., includes the cost of rolling, brazing, and drawing as well as the cost of mixing.

One factor that must be considered in figuring the cost of brass is the zinc loss when mixing. This averages 6 per cent of the total zinc in ordinary practice and may be as high as 10 per cent if the mix is overheated.

TARIFF HISTORY.

Manufacturers of copper alloys such as brass and bronze have not been treated as separate items in the tariff acts. The crude alloys are provided for in paragraphs 413, 430, and 460 of the act of 1913.

Broken bells and bell metal have been specifically provided for on the free list in every tariff act since and including the act of 1883.

In the act of 1883 brass in pigs, bars, old and scrap was dutiable at 1½ cents per pound. All other alloys in which copper was the metal of chief value were included with copper at 3 cents per pound. The duty on brass was retained in the act of 1890, but that on other copper alloys was reduced to 1 cent per pound.

In the act of 1894 the duty on brass was changed to 10 per cent ad valorem (an increase) while other copper alloys, being classed with copper, were admitted free.

In the act of 1897 all unmanufactured alloys of copper were placed on the free list. This classification has been continued until the present time.

COMPETITIVE CONDITIONS.

The domestic manufacturers of brass and bronze have one powerful factor in their favor in that copper, the metal most used, is produced here in larger quantities than anywhere else in the world. This

enables the domestic industry to obtain the larger part of their raw material from nearby sources, a condition unequaled in any other country.

The brass supply of the foreign casting industry is mixed at the foundry because of the zinc loss on remelting, and as no brass bars or cast plates enter into the export statistics the foreign rolling and wire industry evidently find it to their advantage to import their copper from the United States, their zinc from Germany or Belgium, their tin from the East Indies, and to mix the alloy themselves. In this way the mill is sure of the composition and can better control the product.

The strength of the German, French, and English rolling mill industries lie in the large domestic demands and the accessibility of the component metals due to ocean transportation. The European nations have been in a better position than the United States regarding zinc. German and British zinc quotations were persistently lower than those prevailing in the United States before the war. Europe must import a large part of the copper and all of the tin used, the copper from the United States and the tin from the East Indies. Germany is a large zinc producer, and Belgium smelts large tonnages of imported ores.

TARIFF CONSIDERATIONS.

The tariff classification of brass as such and other alloys of copper as bell metal or as composition metal in which copper is the metal of chief value places all brasses and bronzes on the free list. In the present tariff, paragraphs 413 and 430 are superfluous since they include nothing not included in paragraph 460 as composition metal, in which copper is the metal of chief value.

Sheathing or yellow metal might well be omitted from the copper manufactures (paragraph 147). Sheathing is common yellow brass in sheets of certain dimensions and should be classified with other brass sheets. The manufacturing process is the same in every case, and the division causes confusion.

Brass and bronze plates, sheets, strips, tubes, pipes, and pipe fittings are very important manufactures which deserve special paragraph treatment similar to that given the manufactures of copper, zinc, lead, and aluminum.

Brass and bronze—Production in United States.

[From Census of Manufactures, 1910, pp. 462-463.]

	1899	1904	1909
Brass castings and brass finishings	$23,891,248	$29,671,928	$41,317,657
Brassware	16,803,764	17,499,056	29,999,793
Bronze castings	2,229,329	2,622,495	5,037,158
Brass	1,419,817	700,772	2,117,018
All other			
Total	44,344,158	50,494,251	78,471,626

Brass and bronze—Production in United States—Continued.

[From Census of Manufactures for 1914; price list No. 34 issued by War Industries Board for 1917.]

	1914	1917		1914	1917
		Pounds.			*Pounds.*
Ingots and bars	$7,460,396	.....	Wire, plain	$5,851,670	50,690,000
Castings	.....	120,266,000	Other products	73,854,102	75,584,000
Plates and sheets	25,928,193	476,186,000	All other	.....	.....
Rods	8,277,388	279,374,000			
Tubing, seamless	6,967,813	70,408,000	Total	131,503,724	1,072,508,000
Tubing, brazed	3,164,162	.....			

Brass—Composition metal, copper chief value [1]*—Imports by countries (fiscal years).*

Imported from—	1913		1914		1915	
	Pounds.		*Pounds.*		*Pounds.*	
Germany	1,171,654	$220,974	996,854	$180,419	77,088	$14,140
France	279,773	44,865	292,969	43,784	41,292	7,020
United Kingdom	113,952	19,304	49,197	8,467	400	152
Cuba	19,969	2,505	176,855	21,116	92,004	9,807
Canada	32,105	2,411	31,224	3,738	11,797	1,078
All other	33,017	3,953	77,784	8,397	1,120	129
Total	1,650,470	294,012	1,624,883	265,921	223,701	32,326

[1] Included in "Pigs, ingots, bars, plates, and old," prior to 1913.

Brass—Composition metal, copper chief value—Imports by countries.

FISCAL YEARS.

Imported from—	1916		1917		1918	
	Pounds.		*Pounds.*		*Pounds.*	
France	17,322	$2,889	.....	.....	.....	.....
United Kingdom	33,301	9,134	4,410	$776	109,187	$22,762
Cuba	182,589	28,812	177,665	37,771	121,153	28,027
Canada	175,622	38,781	136,672	24,270	26,427	5,803
Chile	9,009	998	81,443	13,544	18,207	3,117
Peru	11,051	1,258	36,895	6,184	33,794	3,050
All other	126,617	22,167	36,902	7,534	24,168	5,458
Total	555,511	104,039	473,987	90,079	332,936	68,217

CALENDAR YEARS.

Imported from—	1918		1919	
	Pounds.		*Pounds.*	
England	54,945	$12,569	.....	.....
Scotland	.....	.....	223,689	$55,943
Canada	39,210	8,149	22,412	3,387
Salvador	3,488	1,339	.....	.....
Newfoundland and Labrador	32,138	5,785	.....	.....
Cuba	56,347	13,134	11,061	1,628
Dominican Republic	5,370	776	.....	.....
Chile	11,918	1,753	.....	.....
Ecuador	.....	.....	98,820	3,070
Peru	4,259	586	.....	.....
All other	.....	.....	.....	.....
Total	207,675	44,091	355,982	64,028

Brass, and manufactures of brass, fit only for remanufacture—Imports by countries (fiscal years).

Imported from—	1910		1911		1912	
	Pounds.		*Pounds.*		*Pounds.*	
Belgium					1,087	$89
France	11,967	$1,141	686	$35	13,577	1,230
Germany	1,814,085	314,324	1,650,086	318,705	894,492	159,455
United Kingdom	3,066,656	338,951	646,146	69,719	56,962	5,108
Canada	922,726	77,078	961,954	71,810	2,444,999	202,070
Mexico	200,228	20,363	178,504	17,292	328,420	28,852
Cuba	322,886	33,421	284,875	24,592	379,214	32,640
Chile			113,605	6,918		
All other	165,664	13,107	118,567	9,491	85,204	8,496
Total	6,504,212	798,385	3,954,423	518,562	4,203,955	437,940

Imported from—	1913		1914		1915	
	Pounds.		*Pounds.*		*Pounds.*	
Belgium	22,566	$2,043	2,600	$250		
France	23,924	3,515	75	4		
Germany	1,448,270	208,281	1,333,160	229,190	211,520	$39,238
United Kingdom	1,124,324	133,466	580,402	65,960	96,653	9,162
Canada	4,798,121	396,163	3,624,185	328,047	4,583,675	432,362
Mexico	526,258	57,080	549,725	50,095	562,339	38,908
Cuba	417,225	33,429	685,700	63,896	385,733	32,820
Brazil	174,163	18,587	23,518	2,238	143,332	17,163
Chile	80	9	10,104	781	122,933	14,301
All other	353,971	41,560	432,201	32,982	1,066,452	79,116
Total	8,888,902	894,133	7,241,670	773,443	7,172,637	663,070

Imported from—	1916		1917		1918	
	Pounds.		*Pounds.*		*Pounds.*	
France	213,400	$10,121	500	$50	21,268	$935
United Kingdom	55,776	8,503	35	5		
Canada	32,131,628	4,215,558	50,121,771	8,351,317	31,684,822	5,453,228
Mexico	841,715	80,512	255,823	37,925	228,371	37,392
Cuba	900,660	108,189	871,831	138,192	245,063	40,339
Brazil	243,567	44,387	525,898	128,980	84,967	21,120
Chile	117,307	12,919	229,234	47,367	11,232	435
All other	201,551	21,200	268,012	31,961	555,352	73,351
Total	34,705,604	4,501,389	52,273,104	8,735,797	32,831,075	5,626,800

Brass, fit only for remanufacture—Imports by countries (calendar years).

Imported from—	1918		1919	
	Pounds.		*Pounds.*	
France	21,468	$955	539	$62
United Kingdom			1,874,480	302,450
Canada	11,169,738	1,613,774	13,776,163	1,833,290
Panama	83,094	12,333	41,663	3,939
Mexico	616,519	99,264	54,321	5,046
Cuba	199,676	27,356	68,964	6,707
Brazil	16,479	2,878		
All other	123,815	17,442	59,041	6,454
Total	12,230,789	1,774,002	15,875,171	2,157,948

Brass: Manufactures of—Imports by countries (calendar years).

Imported from—	1918 [1]	1919	Imported from—	1918 [1]	1919
France	$8,763	$65,752	British India	$5	$1,090
Netherlands	2,146	3,282	Hongkong	662	8,468
Sweden		9,573	Japan	10,119	25,408
Switzerland	16,223	18,959	All other	325	4,082
United Kingdom	41,881	108,076			
Canada	89,567	51,583	Total	170,145	298,604
China	449	2,331			

[1] July 1 to Dec. 31, 1918.

Brass, and manufactures of: Brass, old brass, clippings from brass, or Dutch metal, fit only for remanufacture—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1908	Free	2,688,942	$427,496.00		$0.159	
1909	do	3,720,418	470,578.28		.126	
1910	do	6,501,705	798,767.50		.123	
1911	do	4,087,315	523,476.00		.128	
1912	do	4,065,226	437,811.00		.108	
1913	do	8,750,988	893,224.50		.102	
1914	do	7,220,296	765,319.38		.106	
1915	do	7,594,532	664,753.00		.088	
1916	do	34,753,588	4,501,510.00		.130	
1917	do	53,307,225	8,737,010.00		.164	
1918	do	32,731,025	5,643,382.00		.172	
1918 [1]	do	12,228,988	1,773,789.00		.145	
1919 [1]	do	15,865,946	2,157,043.00		.136	
1920 [1]	do	45,363,942	5,244,715.00		.116	

[1] Calendar year.

Brass and manufactures of: Brass ashes—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1913	Free	324,106	$3,046.00		$0.009	

Brass and manufactures of [1]—Domestic exports (fiscal years).

Exported to—	1910	1911	Exported to—	1910	1911
Austria-Hungary	$3,248	$42,943	Argentina	$53,406	$67,303
Belgium	27,100	51,789	Brazil	28,222	28,786
France	93,486	190,631	Chile	12,830	21,862
Germany	197,693	506,742	Australia and Tasmania	116,859	111,911
United Kingdom	1,038,896	1,840,252	Philippine Islands	78,055	69,488
Canada	2,023,580	2,631,939	All other	279,246	309,846
Panama	92,588	44,716			
Mexico	165,342	147,671	Total	4,355,561	6,230,092
Cuba	145,010	164,213			

[1] Stated separately as "Scrap and old, etc.," "Bars, plates, sheets, etc.," and "Articles made from," after 1911.

Brass: Scrap and old, fit only for manufacture [1]*—Domestic exports (fiscal years).*

Exported to—	1912		1913		1914	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Austria-Hungary	639,414	$66,873	433,109	$50,618	799,960	$94,839
Belgium	1,106,745	104,601	117,732	12,613	144,814	14,351
France	4,414,169	420,465	1,726,911	188,694	2,493,634	259,351
Germany	6,168,943	638,854	4,777,282	496,287	9,391,315	1,017,843
Italy	120,728	14,512			286,937	40,925
Netherlands	799,656	78,728	376,780	43,982	730,645	83,304
Norway	3,640	373				
United Kingdom	22,023,739	2,074,302	9,381,831	1,022,758	10,315,875	1,033,444
Canada	2,400,262	253,361	2,881,172	342,853	1,563,899	168,822
Cuba						
All other					11,766	1,323
Total	37,677,296	3,652,069	19,694,817	2,157,905	25,738,845	2,714,202

[1] Included in "Brass and manufactures of" prior to 1912.

Brass, scrap and old, fit only for remanufacture—Domestic exports.

FISCAL YEARS.

Exported to—	1915		1916		1917	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
Belgium	13,062	$1,200				
France	1,526,069	162,779	1,650,444	$372,065	2,543,745	$476,779
Germany	478,845	46,315				
Italy	26,998	3,750	1,175,689	193,897	798,288	127,179
Netherlands	127,434	12,439				
United Kingdom	12,423,814	1,218,855	1,609,329	200,765	153,906	25,572
Canada	1,169,767	130,663	713,191	106,030	6,741,056	1,349,327
All other	18	2	13,640	1,868	3,284	427
Total	15,766,007	1,576,003	5,162,293	874,625	10,240,279	1,979,284

Exported to—	1918	
	Quantity.	Value.
	Pounds.	
France	2,508,168	$444,998
Italy	1,218,547	316,960
Canada	768,507	150,726
Total	4,495,222	912,684

CALENDAR YEARS.

Exported to—	1918		1919	
	Pounds.		*Pounds.*	
Denmark			22,325	$4,912
France	3,291,338	$538,003	1,756	158
Netherlands			11,200	1,500
United Kingdom			545,201	58,339
Canada	1,607,927	259,540	441,229	57,192
Honduras			2,635	550
Salvador			1,000	212
Cuba	10,555	1,775	13,681	1,629
Venezuela			500	86
Japan			282,240	51,450
Total	4,909,820	799,318	1,321,767	176,028

Composition metal, copper chief value [1]*—Domestic exports (calendar years).*

Exported from—	1918		1919	
	Pounds.		*Pounds.*	
England	11,200	$6,440	68,120	$17,305
Canada	68,803	22,177	39,318	12,867
Mexico	2,063	642	8,565	2,280
Cuba			10,047	3,548
Argentina			23,278	4,252
Brazil	3,275	1,019	4,258	1,606
Chile	16,777	5,483	4,394	1,534
China			78,871	25,855
Dutch East Indies	16,582	4,300	1,545	892
Japan	24,809	6,056	200	75
Other British Oceania	4,214	1,532	5,900	2,170
Philippines	6,524	1,829	92,452	28,010
French Africa	2,240	679	2,973	920
All other	29,773	9,971	24,168	8,718
Total	186,260	60,128	364,089	110,032

[1] Not separately stated prior to 1918.

Brass and other copper alloys in which copper is the metal of chief value, unmanufactured—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883	186	* * * and all composition metal of which copper is a component metal of chief value, not specially enumerated or provided for in this act.	3 cents per pound.
1883	187	Brass, in bars or pig, old brass, and clippings from brass or Dutch metal.	1½ cents per pound.
1883	651	Bells, broken, and bell metal broken and fit only to be remanufactured.	Free.
1890	189	Brass, in bars or pigs, old brass, clippings from brass or Dutch metal, and old sheathing, or yellow metal, fit only for remanufacture.	1½ cents per pound.
1890	192	* * * and all composition metal of which copper is a component metal of chief value, not specially provided for in this act.	1 cent per pound.
1890	503	Bells, broken, and bell metal broken and fit only to be remanufactured.	Free.
1894	159	Brass, in bars or pigs, old brass, clippings from brass or Dutch metal, and old sheathing, or yellow metal, fit only for remanufacture.	10 per cent ad valorem.
1894	452	* * * and all composition metal of which copper is a component metal of chief value, not specially provided for in this act.	Free.
1894	398	Bells, broken, and bell metal broken and fit only to be remanufactured.	Do.
1897	492	....do....	Do.
1897	505	Brass, old brass, clippings from brass or Dutch metal, all the foregoing, fit only for remanufacture.	Do.
1897	533	* * * and all composition metal of which copper is a component metal of chief value, not specially provided for in this act.	Do.
1909	508	Bells, broken, and bell metal broken and fit only to be remanufactured.	Do.
1909	521	Brass, old brass, clippings from brass or Dutch metal, all the foregoing, fit only for remanufacture.	Do.
1909	545	Composition metal of which copper is the component metal of chief value, not specially provided for.	Do.
1913	413	Bells, broken, and bell metal, broken and fit only to be remanufactured.	Do.
1913	430	Brass, old brass, clippings from brass or Dutch metal, all the foregoing, fit only for remanufacture.	Do.
1913	460	Composition metal of which copper is the component metal of chief value, not specially provided for.	Do.

COURT AND TREASURY DECISIONS.

This paragraph covers composition metal itself and not the articles composed thereof. (Abstract 36762, T. D. 34865, of 1914.) *Old bullet jackets*, used or rejected, having copper as their component material of chief value, assessed under paragraph 384 as waste, were held to be free of duty under this paragraph as composition metal of which copper is the component material of chief value. (G. A. 8189, T. D. 37725, of 1918, following G. A. 5061, T. D. 23469, of 1902.) *Thin sheets of Dutch metal*, 33½ inches long by 8½ inches wide, have also been held to come within this paragraph. (G. A. 4993, T. D. 23282, of 1901.) Other cases are discussed in a case upon hot-rolled wire rods or bars, 94 per cent copper and 6 per cent phosphor tin, held to be composition metal. (G. A. 6817, T. D. 29296, of 1908.)

Composition metal, of which 90 per cent is copper, has been held entitled to free entry under paragraph 460 of the act of 1913, even though the original form and condition thereof as manufactured gave it a distinctive character and identity as cannon. The removal therefrom prior to importation of the lugs or trunnions served, partially if not entirely, to destroy such identity and character and so changed the form and condition of the article as to render it susceptible of tariff classification merely as composition metal of which copper is the chief value. (G. A. 8350, T. D. 38439.)

Brass skimmings or ashes fit only for remanufacture are exempt from duty as old brass. (Abstract 33646, T. D. 33763, of 1913; G. A. 5180, T. D. 23873, of 1902.)

Clippings from Dutch metal fit only for remanufacture have likewise been held free of duty (Grempler *v.* United States, 107 Fed., 687), but scraps of Dutch metal leaf known as skewings have been held dutiable as manufactures of metal. (G. A. 4353, T. D. 20682, of 1899.)

ARGENTINE, ALBATA, AND GERMAN SILVER, UNMANUFACTURED.

SUMMARY.

Description and uses.—German silver, albata, and argentine are alloy composed of copper, nickel, and zinc. In the United States the three alloys are placed in one group and called nickel silver.

The alloy is white or slightly yellow in color and resists corrosion better than either zinc or copper. It is used as a base metal in the manufacture of high grade plated silverware, replacing britannia metal and pewter for this purpose. Considerable amounts are used in the manufacture of scientific instruments.

Domestic production.—The United States is the largest manufacturer of nickel silver in the world, supplying the large domestic silverware industry and exporting considerable amounts to Canada.

Foreign production.—England and Germany are the principal foreign producers; most of their production is consumed in the home market.

Imports.—Imports to the United States are confined to scrap metal imported for remelting and remanufacture.

Competitive conditions and tariff considerations.—The United States, as a producer of nickel silver, is in a very advantageous position. The domestic quotation for copper is standard for the world. Although no important nickel ore deposits are worked in the United States, large quantities of Canadian ores and matte are smelted here and domestic nickel silver producers can buy nickel very advantageously in the New York market.

The domestic zinc quotation is usually a little higher than the foreign, but the value of the zinc in a pound of alloy is small.

The domestic position in the copper market is stable and will remain so for some years, but any extension of Canadian nickel smelting facilities would improve the Canadian position with respect to this important raw material. Canadian manufacturers might then be in a position to produce nickel silver in competition with the domestic industry.

Argentine, Albata, or German silver (nickel silver)—Summary table.

Fiscal year.	Value of domestic exports.	Value of imports for consumption.	Amount of duty.	Actual or equivalent ad valorem rate.
				Per cent.
1910	$104,244.00	$479.00	$119.75	25
1911	41,073.00	582.00	145.50	25
1912	56,319.00	1,685.00	408.75	25
1913	65,362.00	481.00	120.25	25
1914	38,691.00	[1] 1,706.00	[1] 426.50	25
1914		[2] 3,694.00	[2] 554.10	15
1915	30,699.00	1,073.00	160.95	15
1916	273,828.00	4,014.00	602.10	15
1917	410,295.00	1,249.00	187.35	15
1918	270,703.00	41.00	6.15	15
1918 [3]	227,439.00	51.00	7.65	15
1919 [3]	389,000.00	429.00	64.35	15
1920 [3]	589,508.00	330.00	49.50	15

[1] July 1, 1913, to Oct. 3, 1913, under the act of 1909.
[2] Oct. 4, 1913, to June 30, 1914, under the act of 1913.
[3] Calendar year.

General Information.

PARAGRAPH 145, TARIFF ACT OF 1913.

"Argentine, albata, or German silver, unmanufactured, 15 per centum ad valorem."

DESCRIPTION AND USES.

Argentine, albata and German silver are silver white or slightly yellowish alloys composed of copper, nickel, and zinc. The percentages of the different metals vary considerably and albata may contain a small percentage of lead.

Argentine and albata have become synonymous with German silver in recent years. The composition of true German silver was originally 55 parts copper, 24.4 parts of zinc, and 20.6 parts of nickel. This analysis was modified a little to give the alloy better rolling or drawing qualities, but the nickel content never fell below 20 per cent.

In recent years the alloy has been cheapened by substituting copper for nickel, and now the highest grade manufactured seldom contains more than 18 per cent nickel. The accepted analysis for this grade is now, copper 58 per cent; zinc, 24 per cent; and nickel, 18 per cent.

The chief use for German silver is as a base metal under silver plate. The color is practically the same as silver, and when the plating wears thin the defect is not as noticeable as is the case when copper or brass is used.

Manufacturers of drawing and scientific instruments use considerable quantities of the metal. It resists corrosion under ordinary conditions and is, therefore, admirably suited for this use.

The alloy rolls and draws well, and it is as sheet that most of the production reaches the consumer.

DOMESTIC PRODUCTION.

The United States is the largest producer of German silver in the world. When Canada increases her nickel smelting capacity the domestic production will probably decrease, as Canada is an important customer.

Materials.—Nickel, copper, and zinc are the raw materials used. The domestic manufacturer occupies a strong position as regards his raw materials. Copper is produced here in larger quantities than in the rest of the world combined. The zinc supply is sufficient and shows no signs of exhaustion. In the case of nickel the position is not as secure. Most of the world's nickel is mined at one locality in Ontario, Canada, but as the mining company is of United States capital and the mines are located at a distance from a fuel supply and a market, the bulk of the matte has always been sent to the United States for refining and sale.

Equipment.—The alloy mixing and founding plants are simple in design and require little capital outlay. A furnace is used large enough to accommodate the crucible in which the metals are melted. As little, if any, German silver is used in the cast form, the founding plants are usually operated in connection with the rolling and wire mills.

Methods of production.—Great care must be exercised in the manufacture of German silver in order that the product may come up to specifications. The copper and nickel are first melted and after a thorough mixing are held at a temperature little above the melting point. The zinc, previously heated to near its melting point, is now added a little at a time and after sufficient time has elapsed for the alloy to become thoroughly mixed, it is cast into bars, plates, etc., for use in the rolling and wire mills.

Organization.—The German silver production is handled and controlled by the large brass producers. The organization is highly centralized in very large plants.

Geographical distribution.—Most of the German silver is produced in Connecticut and New York. The raw materials are all readily available in those States and the product is consumed near the manufacturing plants.

Development of the industry.—The demand for German silver fluctuates with the silver market. When silver is low, more sterling sil-

verware is used and when silver is high priced, sterling ware gives way to the high-grade plate with German silver base.

The development of the high-grade silver plate industry has been a powerful factor in expanding the demand for German silver. The old idea of plated silver was brass, pewter, or copper, with a thin coat of silver that wore off after a short time. With the increase in the price of silver and, in fact, before that time, there arose a demand for a high-grade plate, capable of withstanding long continuous service. The German silverware covered by heavy reenforced silver plate answered the requirement and is rapidly driving sterling silver tableware off the market.

Domestic production and consumption.—The domestic manufacturers produce enough of the alloy to satisfy the home market and supply relatively large tonnages for export. No estimates of total production are available.

The war caused a large increase in the export trade, but the total production was less than in peace times, due to the restriction placed on the use of the alloy in nonessential industries.

Domestic exports.—Exports were unimportant prior to 1910. In that year nickel silver to the value of almost $100,000 was sent to Canada. The exports dropped to $41,000 in 1911, $56,000 in 1912, and $65,000 in 1913. Canada has always been the most important buyer of domestic nickel silver, but substantial amounts were exported to Belgium, England, and Japan.

During the war exports to Canada increased to $322,000 in 1917, the total exports in that year amounting to over $410,000. Since the armistice exports have showed no signs of decreasing; in fact exports for fiscal year 1919 were the largest on record—$499,000.

FOREIGN PRODUCTION.

England and Germany are the principal foreign producers. These nations supply some metal for export, but the greater part of the production is consumed at home. The present tendency toward smelting and refining Canadian nickel ores in Canada may result in increased production of nickel silver in that country.

IMPORTS.

Imports of nickel silver, which are in large measure old and scrap metal, fluctuate considerably from year to year. No records are available which show the exporting nations. A large part of the total is new scrap imported from Canadian plants for remelting. Imports for 1916 were the largest on record in recent years—$4,014.

PRICES.

Prices depend on the composition of the alloy as well as on the supply and demand. Foreign quotations are higher than the domestic because of the fact that the domestic quotations for copper and nickel [1] are standard for the world, and foreign quotations for those

[1] This statement is subject to occasional lower prices of English and French smelted nickel in Europe, but both England and France must import American nickel to supplement their supplies.

metals are usually greater than the domestic by an amount equal to the freight and handling cost.

TARIFF HISTORY.

In the act of 1883 and 1890, german silver and associated alloys were dutiable at 25 per cent.

The act of 1894 reduced the duty to 15 per cent, but the higher rate was restored in the act of 1897, and remained unchanged under the act of 1909.

The act of 1913 reduced the rate to 15 per cent.

COMPETITIVE CONDITIONS.

At present the European market for both copper and nickel is based on the New York quotation, and so long as this factor remains unchanged the domestic manufacturer occupies a very advantageous position. The foreign manufacturer must use the United States metal or buy foreign supplies at an increase over the New York price to cover the cost of ocean freight.

The foreign price of zinc was usually a little below the domestic prior to the war, but the amount of zinc used per pound of German silver is small.

The strength of the domestic position in nickel is based on the large nickel refining industry located near New York City. New York is an ideal location for the refining industry, since fuel supplies are convenient and near-by markets consume large quantities of the metal.

During the war, when the military importance of nickel became apparent, the fact that no Canadian nickel was refined in Canada created considerable feeling against the mining companies. To satisfy popular demand a refinery was built near Port Colburn, Ontario, Canadian alloy producers can now, therefore, obtain refined nickel in Canada and need not import the metal from New York.

Argentine, Albata, or German silver—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Value.	Quantity.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
			Pounds.			*Per cent.*
1910	25 per cent	$479.00		$119.75		25
1911	do	582.00		145.50		25
1912	do	1,635.00		408.75		25
1913	do	481.00		120.25		25
1914	do	1,706.00		426.50		25
1914	15 per cent	3,694.00		554.10		15
1915	do	1,073.00		160.95		15
1916	do	4,014.00		602.10		15
1917	do	1,249,00		187.35		15
1918	do	41.00		6.15		15
1918[1]	do	51.00		7.65		15
1919[1]	do	429.00	[2]3,074	64.35		15
1920[1]	do	330.00	200	49.50		15

[1] Calendar year.

[2] Quantity not shown prior to 1919.

Argentine, albata, or German silver (nickel silver)—Domestic exports (fiscal years).

Exported to—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1918[1]	1919[1]	1920[1]
Belgium	$3,844	$3,997	$6,743	$20,407	$10,152	$2,010	.....	.....	.....	.....	.....	$1,107
England	966	8,332	15,266	7,915	3,197	11,703	$29,406	$3,422	$1,841	$1,213	$1,276	535
Canada	97,434	19,229	31,428	31,409	18,017	15,857	220,060	322,480	170,684	193,198	336,125	544,813
Japan	776	7,214	2,594	5,430	235	.....	2,417	18,116	10,168	15,352	7,921	16,428
All other	1,224	2,301	288	201	7,090	1,129	21,945	66,277	88,010	17,676	43,678	26,625
Total	104,244	41,073	56,319	65,362	38,691	30,699	273,828	410,295	270,703	227,439	389,000	589,508

[1] Calendar year.

Argentine, albata, or German silver (unmanufactured)—Rates of duty.

Act of—	Paragraph.	Tariff classification or description.	Rate of duty, specific and ad valorem.
1883	185	Argentine, albata, or German silver, unmanufactured	25 per cent ad valorem.
1890	188	.....do	Do.
1894	158	.....do	15 per cent ad valorem.
1897	174	.....do	25 per cent ad valorem.
1909	174	.....do	Do.
1913	145	.....do	15 per cent ad valorem.

Court and Treasury Decisions.

German silver in sheets from 18 to 24 inches wide, 0.023 to 0.054 inch thick, and about 96 inches long, not polished, but with edges trimmed to an exact width, was held properly classified as a manufacture of metal under paragraph 167 and not dutiable as German silver unmanufactured. (Abstract 38018 of 1915.) This paragraph relates to German silver in an unmanufactured state, such as pigs and ingots. Bars and sheets are not unmanufactured, and such articles of German silver are dutiable as manufactures of metal. (G. A. 5742, T. D. 25478, of 1904; and G. A. 7560, T. D. 34414, of 1914.)

Argentine and albata are practically obsolete terms. The alloy is zinc-copper-nickel.

COPPER ROLLING AND WIRE MILL PRODUCTS (PLATES, SHEETS, PIPES, BOTTOMS, RODS, AND WIRE).

Summary.

The United States rolling and wire mill industry manufactures practically the entire domestic supply of these products, and in addition provides large tonnages for export. The manufacture of copper rods and wire is the most important branch of the industry, because these are the forms in which copper is used in the electrical trades.

The mills are in large units and under centralized financial control. The installation cost is high but every labor-saving device is utilized. Brass and bronze products are generally produced in mills rolling copper and much of the copper wire is produced in plants which produce iron and steel wire as their chief product.

Exports.—Domestic exports are many times the value of the imports. This is especially noticeable in the case of wire. While the United States ships considerable quantities of these products to the

undeveloped nations, our best customers are the manufacturing nations of Europe. Germany was before the war our best customer for sheets, pipes, etc., and Great Britain consumed a large part of our exports of wire.

Foreign production.—Germany, Great Britain, Japan, and France are the principal foreign producers. Japan, because of her export surplus of copper metal, occupies the strongest position as regards the domestic market. All the other nations must import their raw material from the United States and ship the finished product back.

Imports.—The imports of copper rolling and wire mill products are of very minor importance. Wire is the most important product on the list.

Competitive conditions.—The domestic industry occupies a very strong position because of the large export surplus here and the heavy freight handicap under which foreign competition must operate. The trans-Atlantic freight toll counterbalances whatever saving the foreign industry can achieve by reason of cheaper labor, etc.

Were it not for the fact that copper is now being refined and rolled in the west, Japan would be in a position to compete with the domestic industry on the Pacific seaboard. Japan has copper for export and is very skillful especially in the wire industry.

The one outstanding factor is the enormous balance of exports over imports, indicating the ability of the domestic mill products to enter the foreign markets.

Tariff considerations.—The inclusion of brass sheathing with copper products in paragraph 147 causes confusion and litigation. Other similar brass products are dutiable at 20 per cent under paragraph 167. The inclusion in paragraph 114 of copper wire with iron and steel wire at 15 per cent duty causes the former to bear a tax that in the case of coarse wire is often greater than the whole manufacturing cost.

Copper sheets, pipes, plates, braziers, and copper bottoms—Summary table.

[Commerce and Navigation figures.]

Calendar year.	Imports for consumption.	Domestic exports.	Ratio of exports to imports.	Value of imports for consumption.	Amount of duty.	Value per unit of quantity.[1]	Actual or equivalent ad valorem rate.
			Per cent.				*Per cent.*
1911	$12,038	[2]	.....	$12,038	$1,418.82	$0.212	11.8
1912	11,796	[2]	.....	11,796	1,156.01	.256	9.7
1913	36,580	[3] $11,885,890	325	[4] 8,469 [5] 16,345 [6] 11,766	720.61 817.25 (7)	.294 .240 .083	8.5 5.0 .....
1914	62,176	[3] 8,753,920	141	54,227 [6] 7,949	2,711.35 (7)	.212 .184	5.0 .....
1915	4,989	[3] 14,269,311	2,840	4,989	249.45	.272	5.0
1916	16,389	[3] 32,627,162	1,991	16,389	819.45	.309	5.0
1917	81,446	[3] 32,976,942	405	81,446	4,072.30	.366	5.0
1918	269	[3] 12,808,773	47,616	269	13.45	.492	5.0
1919	5,331	[3] 10,855,198	2,036	5,331	266.55	.474	5.0
1920	4,070	[3] 14,483,309	3,559	4,070	203.50	.389	5.0

[1] Values are deceiving, since different products have different prices.
[2] No separate figures available.
[3] All exports except wire.
[4] Dutiable under act of 1909.
[5] Dutiable under act of 1913.
[6] Admitted free for construction of vessels or under Panama act.
[7] Free.

Copper wire—Summary table.

[Commerce and Navigation figures.]

Calendar year.	Imports for consumption.	Domestic exports.	Ratio of exports to imports.	Value of imports for consumption.	Amount of duty.	Value per unit of quantity.	Actual or equivalent ad valorem rate.
			Per cent.				*Per cent.*
1911	$717	(1)	.....	$717	$250.95	$0.553	35
1912	896	(1)	.....	411	143.85	.366	35
				485	218.25	.....	[3] 45
1913	1,213	[2] $6,444,736	5,321.0	880	396.00	.492	45
				333	49.95	.....	15
1914	2,717	[2] 4,870,742	1,782.0	2,717	407.55	.296	15
1915	1,557	[2] 8,448,521	5,426.0	1,557	233.55	.....	15
1916	68,996	6,386,674	92.0	68,996	10,349.40	.....	15
1917	89,922	8,975,078	99.8	89,922	13,488.30	.....	15
1918	3,559	4,750,942	1,335.0	3,559	533.85	[4].580	15
1919	27,088	14,810,357	546.7	27,088	4,063.20	.348	15
1920	50,640	10,191,273	201.2	50,640	7,596.00	.242	15

[1] No figures available.
[2] Includes rods.
[3] Treasury decision 32600.
[4] Imports last 6 months.

General Information.

TARIFF PARAGRAPHS.

Paragraph 147, act of 1913.—Copper, in rolled plates, called braziers' copper, sheets, rods, strips, pipes, and copper bottoms, sheathing or yellow metal of which copper is the component metal of chief value, and not composed wholly or in part of iron ungalvanized—5 per cent ad valorem.

Paragraph 114, act of 1913.—All other wire not specially provided for in this section—15 per cent ad valorem.

USES.

All of the articles mentioned above in paragraphs 114 and 147 are rolling and drawing mill products. The wire, rods, and rolled plates are the most important, since these are the forms used in the electrical industry, which consumes 50 to 60 per cent of all the copper used.

Copper sheets, strips, bottoms, and sheathing are used in the building trades for roofing and flashing, and in the shipbuilding industry for covering the bottoms of vessels as protection against marine growths. Sheet copper bottoms are used in the manufacture of copper cooking utensils, more especially for those parts in contact with the source of heat. The high melting point and heat conductivity of copper make it admirable for this purpose. Sheathing, or yellow metal, is a rather common form of brass, which has been included in the paragraph with copper because it has competed with that metal in shipbuilding.

Copper pipes are used in stills, water heaters, and condensers. The alcohol industry was a large user of this class of material. Small pipes are used as gasoline pipes in automobiles.

SUBSTITUTES.

Zinc and galvanized iron are becoming formidable competitors of copper in sheets and strips used in the building trades. Zinc is cheaper than copper, corrodes very slowly, and does not stain the wood and stone surfaces in contact with it.

Aluminum and iron are replacing copper in the electrical industry to some extent. Telegraph and some telephone wire is now made of iron. The resistance of iron wire is high and its life short, but for telegraph and short distance telephone lines the first fault is unimportant and the latter may be overcome to a large extent by galvanizing.

Although the electrical conductivity of aluminum is only a little more than half that of copper [1] and therefore twice the area of wire is required for the same resistance, on account of the lightness of the white metal slightly less than one-half the weight of metal is necessary. For the older type of electric installations the question as to which metal should be used was merely one of price. If the price of copper were less than half that of aluminum it was selected by the larger companies. If the reverse were true aluminum was chosen. In recent years the development of high-tension transmission lines involving exceptionally large spans between supports, confronted the difficulty in the case of aluminum wire of excessive expansion with temperature changes. When stretched too tight the comparatively low tensile strength of aluminum was exceeded in cold weather and in severe storms, although considerable sag might occur in hot weather. The introduction of a steel core surrounded by aluminum strands conquered this difficulty but increased the cost.

DOMESTIC PRODUCTION.

The manufacture of copper rods and wire is the most important part of the industry, about half of our copper being used in these forms. The consumption of pipes, sheets, tubes, etc., is less than 10 per cent of the total,[2] and because of the success of substitutes this percentage should decrease in the future.

In 1914, out of $82,841,246 worth of copper products produced, almost $53,000,000 was in wire and over $6,000,000 in rods. The combined value of sheets and tubing produced was little over $17,000,000.[3] The value of all other manufactured products of copper was about $5,000,000.

Materials.—Electrolytic or Lake copper is used exclusively for rolling and drawing stock. Very small amounts of impurities decrease the electrical conductivity or the ductility under the rolls.

Equipment.—The domestic rolling-mill plants are generally in large units. The machinery is entirely of domestic manufacture and, because of the high wages paid in the rolling-mill districts, every labor-saving device is utilized. Plant costs are higher in the United States than in Europe or Japan, and labor is better paid here, but this handicap is overcome to some extent by the greater skill of domestic labor.

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[1] Theoretical factor 1.6. [2] Mining Resources, 1914. [3] Census of Manufactures, 1914.

If soft wire is desired the product is annealed, otherwise it is marketed without annealing, being known as hard-drawn wire.

Methods of production.—Copper is either hot or cold rolled, depending on the properties desired in the product. Bars or plates are used for raw material, these being tapered at one end so as to pass through the hole in the drawing plate or catch in the rolls. The material passes through a series of drawing plates or rolls each smaller than the preceding, until the desired thickness of wire or sheet is obtained. If the material is being drawn or rolled to small sizes, it is annealed (heated, and cooled slowly) one or more times to restore the ductility.

Organization.—The copper rolling and drawing mill industry is so closely connected with that of other metals that it is difficult to determine its separate value. There were 41 plants engaged in casting and rolling copper in 1914, and since 1914 the large copper-producing interests have acquired rolling and wire mills to the end that they may in this way control the product from mine to ultimate consumer.

The rolling is done almost entirely by large corporations because the plant investment is high. For this reason, also, sheets and wire of other metals are produced at the mills so that maximum production can be maintained without overstocking the market. Brass is the usual alternate product at the sheet and rod mills, and much of the wire is produced at mills which produce iron and steel wire as their main product.

The figures for 1914 production show clearly the extent that copper products are produced in plants producing products of other metals.[1] In that year $30,722,895 worth of copper products were produced in mills producing these wares alone, while $52,118,351 worth of copper products were produced in plants manufacturing other metal products as well.

Geographical distribution.—Practically all the rolling and wire mills are located within easy reach of New York. The large refineries of copper are near that city and most of the manufacturing plants are in northeastern United States. These conditions give New York and New England plants a powerful advantage in local markets and their location near the Atlantic seaboard lowers the freight toll on foreign shipments.

A glance at the geographical disposition of the wire mills in 1914 will demonstrate the effect of the location of refineries in and near New York.[1] In 1914 out of 28 establishments making copper wire 7 were located in New York, 6 in Connecticut, 5 in New Jersey, 3 in Massachusetts, 2 each in Illinois and Rhode Island, and 1 each in Colorado, Michigan, and Pennsylvania.

The plants in Illinois and Michigan are supplied with raw material by the lake refineries in Michigan, and cater to the middle western trade. The Colorado plant obtains its raw material from Montana, that being the nearest electrolytic refinery.

Since 1914 the Anaconda Copper Mining Co. has erected drawing and rolling mills in Montana. Other copper companies have acquired plants in the East.

[1] Census of Manufactures, 1914.

Domestic production and consumption.—In addition to producing practically the entire domestic supply of copper sheets, rods, wire, etc., United States mills have been producing large tonnages for export for some time. This business was increasing up to the outbreak of the late war. It decreased more than half during the war period but will return to somewhere near the prewar figures as the various European nations return to a peace footing.

It is impossible to determine from available data the tonnage of individual products exported since the commerce and navigation distribution changes from year to year. In the calendar year 1913, exports of rods and wire, plates and sheets, amounted to over 104,000,000 pounds, and this is probably exclusive of pipes and tubes since they are not mentioned specifically. In 1918 the exports, including pipes and tubes, totaled a little over 38,000,000 pounds, practically a 60 per cent reduction.

Our best customers are the manufacturing nations of Europe who account for all but a few hundred tons. Germany was the largest buyer of plates and sheets, and our decreased exports during the war were due in a large part to the allied blockade. The United Kingdom is the largest buyer of domestic copper wire.

FOREIGN PRODUCTION.

Japan, Germany, Great Britain, and France are the principal nations manufacturing rolled products. None of these nations except Japan produces much copper from mines within its own borders, but all roll large quantities of foreign metal for their own markets and for export. Japan is the nation best able to compete with the United States, since in the West, at least, ocean freights from Japan are normally much lower than rail rates from eastern centers.

IMPORTS.

Imports of copper rolling mill products are of very minor importance. In 1914 (calendar year) the total was slightly over 300,000 pounds, as compared with normal exports of 100,000,000 pounds. Wire (presumably the fine sizes) is the most important product on the import list with plates and sheets second.

TARIFF HISTORY.

Under the tariff acts of 1883 and 1890 copper rolling mill products except wire were dutiable at 35 per cent ad valorem. This was decreased in 1894 to 20 per cent and made specific under the acts of 1897 and 1909, the rate being 2½ cents per pound on copper and 2 cents on sheathing.

In 1913 the rate was cut to 5 per cent ad valorem, a decrease of over 75 per cent. Imports increased from 46,000 pounds in 1912 to practically 300,000 pounds in 1914.

In the tariff of 1883 paragraphs 186 and 216 cover copper wire. Paragraph 216 carried the higher duty, i. e., 45 per cent. This rate was retained under the act of 1890 (par. 215), but was cut to 35 per cent under the act of 1894 (par. 177).

In the act of 1909 (par. 135) copper wire was included with iron and steel, the bare wire being taxable at 35 per cent and insulated wire at 40 per cent. In 1913 (par. 114) the duty for both bare and insulated wire was reduced to 15 per cent ad valorem.

The domestic copper rolling and drawing industry is favored in that a large excess of the raw material is produced in the United States. In order for any nation (except perhaps Japan, which also has some exportable surplus of copper) to compete in the domestic market, the costs of production abroad must be sufficiently lower than domestic costs to cancel the cost of shipment both ways across the ocean. Both foreign mills and domestic mills near the Atlantic seaboard draw their raw stock from the same market—New York. In few instances will the rail freight on raw copper to a domestic mill amount to a very large fraction of the cost of ocean shipment to foreign mills. In order to sell their product to consumers in the eastern part of the United States, the foreign producers must pay freight back across the Atlantic. In practically all cases there will be an additional haul from the port of entry to the point of consumption, which would amount to practically as much as the total freight from the domestic mill.

On the Pacific seaboard domestic metal would be at a disadvantage were it not for the fact that electrolytic refineries are operating in that region. The handicap against the Japanese producer is much less than that against the European producer, because Japan has very cheap labor, has copper for export, and is highly skillful in rolling and drawing.

The one outstanding fact in the tariff situation is the large balance of exports over imports. The substantial value of our exports to the manufacturing nations of Europe indicates an ability on the part of the domestic industry to compete with the foreign producer in his home market. Domestic producers of engravers' plates complain of extensive competition. This product is finished very carefully and should not be confused with ordinary rolled plate.

TARIFF CONSIDERATIONS.

There has been much confusion in the past due to the inclusion of sheathing or yellow metal in the paragraph with copper. There is nothing in the manufacture of brass which justifies discrimination for or against any particular kind, unless it be special alloy brasses and bronzes of high tensile strength that compete with alloy steels. The reason for including sheathing with copper sheets, i. e., because it competed with that product in the shipbuilding industry, no longer obtains, and unless it is the intention of Congress to treat all brass and bronze on the same terms as copper, composition metal or yellow metal should be treated under separate heads, such as: (1) Composition metal, copper chief value, and (2) brasses and bronzes.

The copper wire drawing industry is large and well organized, and the value of its products, while not as large as that of the iron and steel wire mills, is nevertheless very great.

The cost of drawing copper wire is small. The difference in price between bar copper and wire being at times as little as 2 cents. Copper is easily drawn and rolled, due to its great ductility.

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Copper, all other manufactures of—Imports by countries.

FISCAL YEARS.

Imported from—	1910	1911	1912	1913	1914	1915	1916	1917	1918
United Kingdom	$28,697	$26,471	$16,709	$29,865	$95,278	$35,757	$20,114	$59,825	$31,993
France	4,456	9,084	15,063	40,391	46,890	20,119	9,464	9,336	27,035
Germany	11,008	7,979	14,998	19,751	35,038	11,057	.....	.....	.....
Canada	3,797	690	279	303	578	5,095	3,392	197,796	61,136
All other	2,566	3,115	5,477	7,039	6,888	2,479	13,406	15,860	16,763
Total	50,524	47,339	52,526	97,349	184,672	74,507	46,376	282,817	136,927

CALENDAR YEARS.

Imported from—	1918	1919
United Kingdom	$32,632	$25,269
France	20,856	23,742
Germany	.....	.....
Canada	25,926	66,615
All other	7,295	10,022
Total	86,709	125,648

(SEE PAGE 35 FOR A COMPILATION OF IMPORTS FOR CONSUMPTION.)

Copper plates and sheets [1]*—Domestic exports.*

FISCAL YEARS.

Exported to—	1913		1914		1915	
	Pounds.		*Pounds.*		*Pounds.*	
Germany	29,527,933	$4,707,728	35,305,672	$5,160,222	1,210,170	$166,862
Netherlands	13,388,894	2,174,931	15,830,774	2,337,610	1,084,383	145,386
France	9,772,414	1,596,591	9,389,132	1,376,828	20,680,346	2,924,252
United Kingdom	2,964,911	479,231	6,280,282	913,911	4,765,728	751,215
Canada	4,145,663	850,939	3,361,940	622,568	3,068,796	516,565
Italy	11,816	2,068	.....	.....	2,409,187	396,756
All other	1,238,507	217,472	1,687,935	279,365	1,137,179	202,742
Total	61,050,138	10,028,960	71,855,735	10,690,504	34,355,789	5,103,778

Exported to—	1916		1917		1918	
	Pounds.		*Pounds.*		*Pounds.*	
Germany	1,558,103	$376,161	500,057	$183,134	52,862	$21,341
Netherlands	11,848,161	2,379,560	10,829,437	2,923,891	6,147,726	1,665,062
France	2,020,724	403,413	9,984,301	2,686,424	19,005,025	5,134,374
United Kingdom	3,585,846	923,914	2,942,240	1,118,704	1,469,223	541,908
Canada	3,119,433	694,987	2,971,287	1,008,969	7,525,350	2,838,046
Italy	1,953,765	487,801	7,398,893	2,165,789	3,227,439	1,200,576
All other	24,086,032	5,265,836	34,626,215	10,086,911	37,427,625	11,401,307

CALENDAR YEARS.

Exported to—	1918		1919	
	Pounds.	Dollars.	Pounds.	Dollars.
Netherlands	.....	.....	618,100	230,714
France	4,547,080	1,231,585	456,355	118,613
United Kingdom	4,757,767	1,385,784	4,285,424	1,158,194
Canada	1,579,979	524,550	1,798,426	511,882
Italy	4,948,479	1,257,040	1,174,289	279,039
All other	3,638,279	1,278,449	5,431,831	1,792,049
Total	19,471,584	5,677,408	13,764,425	4,090,491

[1] Not separately stated prior to 1913.

Copper rods and wire [1]—Domestic exports (fiscal years).

Exported to—	1913		1914		1915	
	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.
Canada	28,657,865	5,001,885	21,692,098	3,501,287	11,104,289	1,672,012
United Kingdom	5,356,703	931,294	6,628,576	1,101,872	16,152,976	2,426,931
Mexico	612,753	112,775	386,190	65,264	110,293	19,034
Cuba	1,142,762	202,396	940,611	149,838	395,155	64,519
Brazil	2,006,796	349,113	562,186	95,127	849,721	122,547
Germany	980,017	159,483	26,656	3,398	.....	.....
Netherlands	1,626,424	261,646	.....	.....	642,194	94,300
Denmark	.....	.....	.....	.....	2,848,147	403,056
France	20,896	3,324	280,285	44,149	4,786,197	838,948
Italy	.....	.....	.....	.....	8,047,007	1,153,638
Norway	.....	.....	.....	.....	4,336,071	608,060
All other	1,055,685	195,250	1,986,633	337,750	3,983,107	601,583
Total	41,459,901	7,217,166	32,503,235	5,298,685	53,255,157	8,004,628

[1] Included in "Pigs, ingots, bars, plates, rods, scrap, and old," prior to 1913, and stated separately after 1915.

Copper wire [1]—Domestic exports (fiscal years).

Exported to—	1916		1917		1918	
	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.
United Kingdom	6,096,133	1,348,221	4,182,154	1,346,733	2,358,387	611,724
France	3,700,623	780,449	9,460,707	3,031,104	5,668,228	1,622,955
Italy	2,897,394	618,948	3,163,955	1,066,949	2,328,772	705,472
Norway	2,766,513	588,026	876,918	250,314	116,854	38,109
Spain	2,453,296	521,104	3,748,456	1,197,302	2,272,186	799,367
Netherlands	1,853,424	389,632	2,357,190	711,517	454,358	161,359
Brazil	618,344	138,220	1,252,997	416,312	914,299	302,994
Cuba	402,834	98,714	475,449	158,021	204,755	75,890
All other	3,342,271	725,436	3,236,135	1,091,234	4,268,484	1,371,358
Total	24,130,832	5,208,750	28,753,961	9,269,486	18,586,323	5,689,228

[1] Not separately stated prior to 1916.

Copper wire—Domestic exports (calendar years).

Exported to—	1918		1919	
	Pounds.	Dollars.	Pounds.	Dollars.
United Kingdom	669,557	200,309	4,599,970	936,940
France	3,627,392	980,374	1,505,510	443,185
Italy	1,785,466	489,152	9,155,242	2,636,260
Norway	902,130	328,237	15,512,542	3,918,591
Spain	2,366,781	738,538	3,810,764	1,014,424
Netherlands	.....	.....	5,911,342	1,645,766
Brazil	1,215,240	343,392	1,997,878	573,606
Cuba	407,201	126,529	616,710	169,700
All other	4,715,787	1,544,411	12,441,644	3,471,885
Total	15,689,554	4,750,942	55,551,602	14,810,357

Copper—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty and ad valorem.
1883	186	* * * In rolled plates, called braziers' copper, sheets, rods, pipes, and copper bottoms, and all manufactures of copper, or of which copper shall be a component of chief value, not specially emunerated or provided for in this act.	35 per cent ad valorem.
1890	195	* * * In rolled plates, called braziers' copper, sheets, rods, pipes, and copper bottoms, also sheathing or yellow metal of which copper is the component material of chief value, and not composed wholly or in part of iron ungalvanized.	Do.
1894	161	* * * In rolled plates, called braziers' copper, sheets, rods, pipes, and copper bottoms, also sheathing or yellow metal of which copper is the component material of chief value, and not composed wholly or in part of iron ungalvanized.	20 per cent ad valorem.
1897	176	* * * In rolled plates, called braziers' copper, sheets, rods, pipes, and copper bottoms, 2½ cents per pound; sheathing or yellow metal of which copper is the component material of chief value, and not composed wholly or in part of iron ungalvanized.	2 cents per pound.
1909	176	* * * In rolled plates, called braziers' copper, sheets, rods, pipes, and copper bottoms, 2½ cents per pound; sheathing or yellow metal of which copper is the component material of chief value, and not composed wholly or in part of iron ungalvanized.	Do.
1913	147	* * * In rolled plates, called braziers' copper, sheets, rods, strips, pipes, and copper bottoms, sheathing or yellow metal of which copper is the component material of chief value, and not composed wholly or in part of iron ungalvanized.	5 per cent ad valorem.

Copper rolling and wire mill products—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty and ad valorem.
1883	216	Manufactures, articles, or wares, not specially enumed orater provided for in this act, composed wholly or in part of * * * copper * * * or any other metal, and whether partly or wholly manufactured.	45 per cent ad valorem.
1890	215	Manufactures, articles, or wares, not specially enumerated or provided for in this act, composed wholly or in part of * * * copper * * * or any other metal, and whether partly or wholly manufactured.	Do.
1894	177	Manufactured articles or wares, not specially provided for in this act, composed wholly or in part of any metal, and whether partly or wholly manufactured.	35 per cent ad valorem.
1897	193	Articles or wares not specially provided for in this act, composed wholly or in part of * * * copper, * * * or other metal, and whether partly or wholly manufactured.	45 per cent ad valorem.
1909	199	Articles or wares not specially provided for in this section, composed wholly or in part of * * * copper, * * * or other metal, and whether partly or wholly manufactured.	Do.
1913	114	* * * all other wire not specially provided for in this section....	15 per cent ad valorem.
	167	Articles or wares not specially provided for in this section; * * * if composed wholly or in chief value of * * * copper, * * * or other metal, but not plated with gold or silver, and whether partly or wholly manufactured.	20 per cent ad valorem.

Court and Treasury Decisions.

Copper plates ground, polished, and planished, and ready for the engraver's use, were held not within this provision. (United States *v.* Deakenfeld, 178 Fed., 258, of 1910.) But copper sheets 15 by 26, 17 by 28, 12 by 36, 20 by 24, 18 by 36, and 22 by 28 inches, 16 or 18 gauge in thickness, also classified as manufactures of metal under paragraph 167, were held to come within paragraph 147. (Abstract 38971, of 1915.) Customs officers, however, were instructed by the Treasury Department to continue assessment of the 20 per cent rate on such so-called sheets under paragraph 167 pending the making of a new case. (T. D. 37152, of 1917.)

BRASS ROLLING MILL PRODUCTS.

SUMMARY.

Brass and bronze are alloys consisting essentially of copper and zinc or of copper and tin. The rolling, drawing, or extrusion of these alloys into sheet, strip, rods, tubes, and wire constitute a large and important industry in the United States, employing a capital of nearly $200,000,000 and producing products valued annually at very nearly the same figure.

As compared with establishments in France, Germany, and England, the chief foreign producing countries, American plants are large, well organized, and efficient. In spite of the fact that American wages are from two to three times those now being paid in European countries, the American brass-rolling mills seem to be in a position to keep their costs down to a competitive level with foreign costs by standardizing their output and concentrating their production along bulk lines. Great progress has been made abroad toward the adoption of modern machinery and methods during and since the war period, especially in England, but it is doubtful if the full benefit has been yet derived from the prevailing lower rate of wages, although prior to the war German and English sheets and tubes were apparently becoming active factors in the American market. In the post-war situation foreign competition has not yet developed to large proportions either in the United States or in neutral markets. The capacity of British mills particularly has been largely increased, but owing to the fact that the world production of rolled brass was largely diverted to war purposes and Germany and France have not as yet established their production on a peace basis, foreign mills are kept busy in supplying the insistent demands of former markets which they were forced to neglect during the war. Japan is expected to enter the field as a producer of rolled brass, but has not yet become a factor in world trade in these goods.

The most highly competitive article in the list of brass-rolling mill products is tubes for use in boilers and condensers. An important consumption of these tubes is in the shipbuilding industry, and it is asserted by domestic manufacturers that the Panama act and the like provisions for the free entry of material for the construction, repair, and equipment of vessels may inflict serious injury to their business.

In view of the size and importance of the brass-rolling mill industry it would seem that a special paragraph should be devoted to brass manufactures and that the various products should be specifically mentioned. Under the act of 1913 these articles come chiefly under paragraph 167 as manufactures of metal, not specially provided for. Brass sheathing is included under the designation "sheathing or yellow metal of which copper is the component of chief value, and not composed wholly or in part of iron ungalvanized" in paragraph 147, which deals mainly with copper manufactures. Sheathing is ordinarily understood to mean sheets for covering the hulls of wooden ships below the water line. Pure copper sheet and more recently hot-rolled brass sheet is ordinarily used for that purpose, but due to the fact that wooden ships are being superseded by steel ships

whose hulls require no such protection, sheathing is becoming a relatively unimportant product. Yellow metal is hot rolled or extruded brass as distinguished from cold rolled or drawn brass, frequently of similar composition. Hence the phrasing of paragraph 147 may be construed to mean various shapes of hot-worked brass and permit their importation under a duty of 5 per cent, as compared with very similar products—particularly cold-rolled brass sheets—which are dutiable at 20 per cent under paragraph 167. The words "and not composed wholly or in part of iron ungalvanized" have no application to sheathing or yellow metal of which copper is the component of chief value.

Brass and bronze rolling-mill products—Summary table.

Fiscal year.	Domestic production.	Imports for consumption.	Domestic exports.	Value (imports for consumption).	Amount of duty.	Actual or equivalent ad valorem rate.
						Per cent.
1910		$363,308.32	(2)	$363,308.32	$163,451.35	45
1911		426,568.34	(2)	426,568.34	191,585.79	45
1912		572,204.90	[1] $5,228,873	572,204.90	257,245.97	45
1913		448,886.44	[1] 6,396,831	448,886.44	201,988.15	45
1914	$131,503,724	598,841.15	[1] 4,758,274	598,841.15	143,510.95	23 96
1915		637,624.00	[1] 18,968,556	637,624.00	127,283.45	20
1916		264,725.00	[1] 164,001,419	264,725.00	52,906.00	20
1917		578,354.00	[1] 381,348,266	578,354.00	115,509.70	20
1918		440,204.00	31,476,696	440,204.00	87,836.96	20
1918[3]		361,584.00	11,367,557	361,584.00	72,157 81	20
1919[3]		452,844.00	4,128,335	452,844.00	84,073.40	20
1920[3]		620,881.00	4,218,224	620,881.00	124,009.45	20

[1] Contains large quantities of products further advanced than by rolling and drawing.
[2] Not separately stated.
[3] Calendar year.

General Information.

PARAGRAPHS, TARIFF ACT OF 1913.

114. * * * all other wire not specifically provided for in this section, * * * 15 per centum ad valorem.

167. Articles or wares, not specifically provided for in this section; if composed wholly or in chief value of * * * copper, brass, * * * but not plated with gold or silver, and whether partly or wholly manufactured, 20 per centum ad valorem.

147. Sheathing or yellow metal of which copper is the component material of chief value, 5 per centum ad valorem.

DESCRIPTION.

Brass and bronze are the most important copper alloys. They are made up into a large variety of forms, and as sheet, strip, rod, wire, pipe, tubes, or castings they enter into practically every important industry. These alloys are easily machined, spun, and stamped and resist corrosion. They are therefore suitable for use in many places where it is impossible to use iron or steel. Rolled and drawn products are usually produced in the same plants, and as the manufacturing processes are similar, they will be covered in one survey.

Brass is essentially an alloy of copper and zinc, but other metals are frequently added to impart desired qualities to the product.[1] When the percentage of copper ranges between 55 and 70 per cent the product is known in the trade as high brass or yellow brass. When the percentage of copper is between 85 and 98 per cent the product is known as bronze or red brass, gold metal, gilding creide, etc. The addition of lead renders the alloy free turning and easy to machine, and this metal is frequently added in quantities up to 4 per cent for screw-machine stock, engraving, etching, etc., although it reduces the malleability in direct proportion to the amount which is used.

Bronze is strictly an alloy of copper with tin, although the majority of so-called bronzes are really mixtures of brass and bronze, containing copper, zinc, tin, and, where good machining qualities are necessary, lead. In commercial bronzes tin constitutes less than 20 per cent of the mixture, copper more than 55 per cent, zinc less than 45 per cent, and lead less than 4 per cent. Bronze is harder and tougher but less malleable than brass. The hardening effect of tin is so great that the addition of more than 10 per cent makes the product difficult to cold roll or draw.

Admiralty metal is a special mixture used for condenser tubes. These are ordinarily made from 70 per cent copper and 30 per cent zinc, but in Admiralty (British) specifications 1 per cent of zinc is replaced by tin. Some locomotives contain up to 72 per cent copper. The copper content of other tubes varies with the composition of the sheet brass used in their manufacture.

Muntz metal is common brass containing 60 per cent copper and 40 per cent zinc and constitutes the bulk of the output. Yellow metal has a similar composition, but this term is confined in the trade to hot-rolled or hot-drawn brass, now of declining importance in this country.

Iron and manganese render brass and bronze tougher, stronger, and harder, adding materially to the tensile strength but reducing malleability. Aluminum adds to the malleability and elasticity. Phosphorus serves mainly to improve the soundness of ingots.

Nickel silver and pure *copper* rolled and drawn products are closely related to brass and bronze, frequently being made in the same works, but each of these is treated in a separate survey.

Brass-rolling mill products are produced from cast bars and cakes which are rolled and drawn into sheets, rods, wire, and tubes. The products are sold on the basis of composition as well as according to the shape of the material. Price quotations are made for a base size and composition of a standard product, there being additions and deductions for variations in composition, length, width, thickness, diameter, cross section, method of manufacture, and other variables.

[1] For special mixes and trade names, see list of commercial alloys on p. 72, this survey.

Brass and bronze compositions and properties.[1]

Name.	Composition.					Properties.
	Cu.	Zn.	Fe.	Sn.	Ph.	
Aich's metal	60	38.12	1.5			Great tensile strength, 85,000 pounds per square inch.
Acid-resisting metal	83.05	6		10.81	.10	Acid resisting, noncorrosive.
Ajax plastic bronze	65			5	30	
Admiralty brass	61.7	36.9		1.4		Melts at 1,570° F.
Bell metal	80	20				
Cartridge brass	66.66	33.34				Plumber's brass may carry lead.
High brass	61.50	38.50				Typical brass. High naval brass may carry 1 per cent tin.
Low brass	80	20				
Brass solder	50	50				May carry 33 per cent Cu. and 67 per cent Zn.
Bronze coinage	95	1		4		
Bronze bearing	80	7		13		
Do	90	7		3		
Bron e, United States naval.	88	2		10		
Bron e, English gear	88.7			11		Carries phosphorus 0.30 per cent.
Bron e, Tobin	58 22	39.48		2.30		
Ca nelia me'al	70.20	10.20	.55	4.25	14.78	
Delta metal	55.1	43.47	1.08		.37	
Gun metal	87.75	2.50		9.75		
Hydraulic bronze	75	14		11		
Manganin	82.12		.57			Ni. 2.29, manganese 15.02.
Tombac	86.38	13.61				
Muntz metal	62	38				
Manganese bronze	88.6	1.57	.72	8.70	.295	Trace of phosphorus.
Pinch beck	83.33	16.76				
Phosphor bronze	80			10	10	Phosphorus, 0.05–0.25.
Sterro metal	55.33	41.8	4.66			
Biak metal						New metal of great strength.

[1] Metallurgists and Chemists Handbook, Liddell.

USES.

Brass and bronze find a multitude of uses in the trades. The pipes and tubes are used extensively in the plumbing trade for all open piping and fittings. They are used for boiler and condenser tubes in marine and other boilers and for bearing bushings on small-diameter heavy-duty bearings. The railings on passenger ships and war vessels are usually made of brass pipe or tube, and large quantities of the latter product are consumed in the manufacture of brass bedsteads.

Rolled plates and sheets are the raw materials from which are made the better class of builders' and cabinet hardware. The list includes hinges, locks, doorplates, sign plates, and other articles. They are also the raw materials used in the brass-spinning industries producing cartridges, ornamental articles, and an extensive line of electrical fixtures. The consumption of this class of material is increasing yearly.

Yellow metal sheathing was formerly used in great quantity by the shipbuilding industry for covering the bottoms of wooden vessels as a protection against marine worms. This use has ceased to be of any importance because of the substitution of steel for wood in hull construction.

Alloy wire is used in the electrical industry for conductors when tensile strength and wearing qualities are of more importance than electrical conductivity. It is used extensively in the manufacture of wire screens and gratings and to a smaller extent in the manufacture

of transmission and haulage cable. Bolts, screws, nails, rivets, studs, hooks and eyes, and cotter pins are important brass wire products, and the better grade of common toilet pins are composed of brass wire tinned. Large quantities of fine brass wire are consumed in the manufacture of tinsel products, the round wire being first plated and then flattened by passing through accurately spaced rolls.

Thin brass sheets are used for stencils in textile and paper printing.

WAR USES.

A well-equipped and efficient brass-manufacturing industry is absolutely essential for military preparedness. The production units are expensive, requiring heavy machinery and large labor organizations. They can not be assembled on short notice and expansion is necessarily slow.

Practically every brass and bronze product enters into ordnance material and munitions, making the industry second only to iron and steel manufacturing in military importance. Sheet brass is used for the manufacture of small-arms ammunition and strip brass or copper for the rifling bands on projectiles. All marine construction contains large quantities of brass and bronze in the shape of boiler tubes, bolts, sheathing, rivets, and machine parts and trim. Brass and bronze are also important constituents of automobiles and other machinery.

IMPORTANCE OF SECONDARY (SCRAP) METAL.

The uses to which brass and bronze are put in the trades do not destroy the metal, and large quantities reenter the market as scrap. The proportion of scrap is increasing steadily and amounted in 1920 to 60 per cent of the total tonnage melted. The rolling and wire mills produce large quantities of scrap and a considerable amount is returned by cartridge mills and other consumers. This material is consumed by the rolling mills.

Old metal can not be used by the rolling mills because the analysis is highly variable, but is suitable for use in castings where the exact analysis is a matter of little importance. In recent years the production of secondary ingots of guaranteed composition has been developed.

SUBSTITUTES AND COMPETING METALS.

Zinc and galvanized or plated iron are the chief competitors of brass and bronze, especially for pipes and tubes. Brass-plated iron wire is replacing brass to some extent, a large quantity of this material being consumed in the manufacture of wire screens. The substitutes are generally cheaper than brass or bronze, and for uses where the material is not subjected to heavy wear they are satisfactory in every way.

DOMESTIC PRODUCTION.

The United States is the largest producer of brass and bronze and by far the largest part of the production is consumed in the rolling and wire mills. The mills produce intermediate manufactures for the

most part, which require further manufacturing before reaching the ultimate consumer.

The brass and bronze products industry, according to census figures, ranks seventh among the metal trades in number of employees and eighth in value of product. Among all the domestic industries in 1910 it ranked twenty-ninth in number of employees and thirty-fourth in value of product.

In the year 1914, out of a total of $131,503,724 in brass and bronze products, 26 millions was in plates and sheets, 16 millions in ingots and rods, 6 millions in wire, 10 millions in pipe and tubing, and the balance in other manufactured products, such as castings, pipe fittings, machinery parts, and articles manufactured from the semi-finished forms enumerated above.

Estimates of production in 1919, furnished the United States Tariff Commission by manufacturers, ranged between 200,000,000 and 1,000,000,000 pounds. The value of the output was doubtless in the neighborhood of $250,000,000.

Raw materials.—In ordinary brass the copper is the most expensive constituent and zinc (spelter) is of secondary importance. Bronzes sometimes contain as much as 25 per cent tin, and as tin is normally from two and one-half to three times the price of copper, in some bronzes the value of the tin content exceeds that of the copper. In nickel silver, which is occasionally worked up in the same mills, the value of the nickel contained usually approaches but seldom equals the value of the copper.

The raw materials for the manufacture of rolling and wire mill products are cakes and rods of the alloy produced by mixing the various metals in the liquid state and casting in suitable molds. In the United States the entire process is usually carried on by the rolling mill company.

American manufacturers generally are at no disadvantage as compared with those in other countries in securing their supplies of raw metal. In fact, it may be said that the domestic industry has a slight advantage in buying copper because of the large domestic production is about on a par with foreign producers in buying tin; and in normal times is at a slight disadvantage in buying zinc because of cheap and efficient labor in the European zinc-smelting industry and the availability of cheap Australian ore. Zinc, however, was cheaper in the United States than in Europe during the last year of the war and into the fall of 1920.

Equipment.—Sheet, tube, and wire manufacture requires heavy, expensive machinery and large units of production. The equipment used in the United States has been designed and perfected to conform with American production methods, and all classes of requisite machinery are obtainable in adequate supply and of good quality. German and English machinery is on the domestic market to some extent, and before the war a few domestic manufacturers installed some German machinery, especially water-cooled rolls, which are offered at somewhat lower prices than similar equipment of domestic make.

The tendency of the domestic industry has been to specialize on the production of standard sizes of product, so as to permit of large-scale outputs in every branch of the industry. This development has

been of great value to domestic manufacturers, because machinery and processes could be standardized and operating costs, on the standard sizes at least reduced to a minimum. The European rolling-mill industry manufactures a large variety of shapes and sizes, and for this reason have not been able to standardize their equipment and processes so as to permit of large-scale production. England and France as well as Germany, however, have made important strides in the production of rolling-mill machinery as a result of the war, and the quality of foreign equipment has improved greatly because of the increased use of machinery in foreign mills.

The melting and mixing process remained stationary from the early days of the industry. The crucible furnaces used were wasteful of fuel and metal, but until the electric furnace was adopted for this work during the war period the entire brass production was melted in this way. During 1918 electric furnaces of large capacity were tried out and proved so satisfactory that practically all new American installations are equipped with this style of apparatus. The fuel cost when melting in electric furnaces is usually higher than when crucible furnaces are used, but a large saving is made in labor and metal cost, and the heat can be perfectly controlled at all times so that the physical and chemical properties of the product can be easily regulated.

Methods of production.—The brass and bronze manufacturing industry in the United States is conducted to a large extent in plants which carry the manufacturing process through all stages from the melting of the component metals to the production of thin sheets and fine wire. The machinery and methods used are generally well standardized. Little special machinery is required and the bulk of the work is conducted on a quantity output basis. Electricity is the principal power. While standardization in brass rolling mills has reached a higher degree of perfection in the United States than in foreign countries, it has not attained the same degree of perfection that it has in the steel mills, and because of the smaller units involved a much larger amount of labor is required per unit of product.

The outstanding features of the domestic brass and bronze rolling mill practice are: (1) The development of the electric furnace for melting the alloy, (2) the development of the extrusion or squirting process as a substitute for rolling, (3) efficiency of plant design, and (4) restriction of the output to a small number of standard sizes and weights of product.

(1) The electric furnace has been discussed under "equipment."

(2) The extrusion process is distinctly an American development and was not used in Europe prior to the war. The alloy is heated until it is plastic and then pressed through dies of any desired size or shape. The product is finished in one operation, thus eliminating all interprocess handling and annealing.

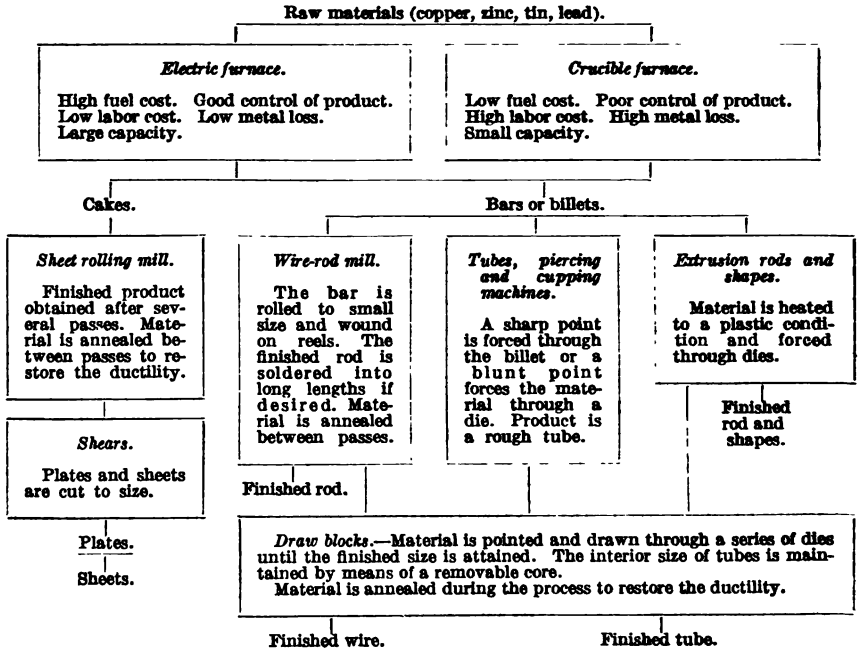
(3) Domestic brass-rolling mills are designed so that the process and flow of material is continuous in one direction. Handling labor is eliminated wherever possible through careful arrangement of machines and extensive use of conveying machinery. European plants are generally at a considerable disadvantage in this respect.

(4) The domestic mills produce a relatively small number of standard shapes and sizes. They manufacture small lots of other

sizes, but as any deviation of the standard practice is expensive the producers are forced to charge heavy premiums for material made on special order. This practice discourages the demand for special sizes and facilitates large-scale production.

A flow sheet outlining the various branches of the production accompanies this text. The alloy is prepared by melting copper ingots, adding zinc and other metals as desired, and then casting into the most desirable forms, billets, bars, cakes, etc., for the later operations. These are transported to the rolling mill, extruded rod mill, tube mill, sheet mill, wire mill, etc. All subsequent operations are mechanical processes, involving the use of more or less automatic machinery, mostly of standard type, such as overhauling and scraping machines, rolls, extrusion presses, draw benches, saws, pointing machines, coiling machines, and trimming and slitting machines. While in process it is necessary to pass the metal through muffle or oil furnaces in order to anneal or soften the alloy, as it becomes hard and brittle when worked. The material is heated to a cherry red in the furnace and then cooled by a water spray or bath. The surface of the piece is cleaned by immersion in an acid bath after each pass through the annealing furnace.

Flow sheet of the principal brass and bronze manufacturing processes.


Raw materials (copper, zinc, tin, lead).
Electric furnace.
High fuel cost. Good control of product.
Low labor cost. Low metal loss.
Large capacity.
Crucible furnace.
Low fuel cost. Poor control of product.
High labor cost. High metal loss.
Small capacity.
Cakes.
Bars or billets.
Sheet rolling mill.
Finished product obtained after several passes. Material is annealed between passes to restore the ductility.
Wire-rod mill.
The bar is rolled to small size and wound on reels. The finished rod is soldered into long lengths if desired. Material is annealed between passes.
Tubes, piercing and cupping machines.
A sharp point is forced through the billet or a blunt point forces the material through a die. Product is a rough tube.
Extrusion rods and shapes.
Material is heated to a plastic condition and forced through dies.
Shears.
Plates and sheets are cut to size.
Finished rod and shapes.
Finished rod.
Plates.
Sheets.
Draw blocks.—Material is pointed and drawn through a series of dies until the finished size is attained. The interior size of tubes is maintained by means of a removable core.
Material is annealed during the process to restore the ductility.
Finished wire.
Finished tube.

All of the above processes require the exercise of considerable muscular strength, which prohibits the employment of women and child labor. Most of the work is performed by relatively unskilled male labor, but certain work, such as regulating rolls and operating the extrusion presses, calls for a high degree of skill and experience. At

one representative plant 35 per cent of the operatives are skilled male labor. None of the work can be done at home or in prison workshops.

The amount of power required for rolling-mill operation varies with the size of the plant and the character of the operations performed. The rolls require from 100 to 500 horsepower per stand, the power varying with the size and speed of the rolls and width and thickness of the metal. The slitters, shears, and other auxiliary machinery require from 10 to 50 horsepower per unit. In making tubes the piercing machine requires from 250 to 500 horsepower, according to the size of billet to be pierced, while the draw benches require from 30 to 300 horsepower each, depending upon the size of tubes to be drawn. The saws, shears, and other auxiliary machinery require from 10 to 75 horsepower per unit. None of the machinery used in making tubes is wholly automatic, since every machine requires from two to six men to feed and manipulate the metal while in process.

Organization.—The domestic brass and bronze rolling and wire mill industry is conducted in large, highly organized units. The important manufacturers control the product from the melting of the constituent metals to marketing the finished pipes, tubes, sheets, and wire. The markets served by the large producers are national in character.

The census reports 904 establishments in the United States manufacturing brass and bronze products in 1914. These figures, however, are misleading, because most of the concerns listed were small foundries which manufacture bearing metals and castings. The bulk of the rolling and wire mill industry is carried on in about 12 of the largest plants, several of which are owned by one corporation.

In 1914 the capital invested in all branches of the industry amounted to $95,827,707 and the manufacturing establishments gave employment to 37,627 persons. According to the estimates furnished to the Tariff Commission by a committee appointed by the brass trade, the amount of capital invested in the brass rolling and tube industry in the United States is approximately $50,000,000, which is divided between some 23 concerns, several of which have more than one plant. Very few rolling mills performing basic operations have a capacity of less than five or six million pounds annually, and there are a large number of establishments whose outputs are greater. According to estimates of several manufacturers based upon gross receipts of $200,000,000 during 1920, the capital invested in the manufacture of brass and copper sheet, tubes, and rods, but including reserves and inventory, exclusive of copper wire and brass parts further manufactured than rolled or drawn, is $175,000,000, no consideration being taken of good will and knowledge of manufacturing methods. To secure the gross annual yield of $200,000,000 in manufactured brass and copper sheets, etc., 665,000,000 pounds of raw material would be purchased, having an estimated value of $106,000,000, and equipment having an estimated value of $175,000,000 is required in the operation.

A few mills produce either copper or brass exclusively, but in most of the American establishments, especially sheet mills, both brass and copper are rolled and several mills also work on nickel silver. So far as known, however, no brass or copper rolling mill in the United States also rolls aluminum, zinc, or iron sheets.

There are 7 manufacturers of seamless drawn tubes. The manufacture of this is even less widely distributed, the production being [illegible] seven or eight companies. These companies perform all the basic operations and carry the product through to finished [illegible] the same plants.

The raw materials are usually bought in large quantities, and it is [illegible] practice in this country to buy metal for future delivery and to [illegible] market fluctuations by selling the product for [illegible] basis. This practice is more common [illegible] American mills must usually purchase fairly large stocks of metal at the time the product after it has been made, thereby involving a certain amount of speculation owing to the close differentials between metal prices and selling prices on finished products.

Geographical distribution.—It is estimated that from 65 to 75 per cent of the sheet brass rolled in the United States is produced in the State of Connecticut, the remainder being rolled in New York, New Jersey, Ohio, Michigan, and Wisconsin, with one large manufacturer in Massachusetts. Probably 90 per cent of the domestic production of all classes of rolled brass and copper products comes from the above-mentioned States. There is one large mill in process of construction in Virginia. Brass wire is produced almost wholly in the East, the plants being located in Connecticut, New York, and New Jersey.

History of the industry.—The American brass industry dates from about 1802, but was not on a stable basis until 1830, when American rolled brass became a factor in the market. The industry grew steadily from that time on, aided by the current import duties on brass manufactures and the rapidly growing domestic copper production. The invention of the spinning process by Hayden in 1851 was the first American contribution to the manufacturing procedure. From this time the domestic industry forged ahead and soon took the lead from their English competitors. The extrusion process for manufacturing brass rods and shapes in one operation is also an American development, which has further increased the lead of the domestic producers over foreign competition in the basic standard products.

Domestic production and consumption.—The capacity of the domestic brass and bronze industry is sufficient to supply the entire domestic market and provide a large surplus for export. During the war the industry expanded to cover the demands of the allied nations, but even this was not sufficient, and when the armistice was signed manufacturers were some months behind on deliveries. The chief products used in the war period were strip brass for cartridge shells, tubes for marine boilers, and sheathing for use on the bottoms of wooden ships. Much of the new equipment installed during the war period has not been operated since the signing of the armistice. Consumers during the past 25 years have generally had time and facility in securing the supplies they required. Although the character of the American output is along bulk lines and a few special shapes and sizes must occasionally be imported.

The estimated total capacity output of tubes is approximately 140,000,000 pounds per annum, but because of present restricted demand the 1920 output of this product probably will not amount to over 75,000,000 pounds. The industry was overexpanded during the war. On the basis of 50 per cent of tubes manufactured be-

of brass (45,000,000 pounds) and 40 per cent of copper (30,000,000 pounds) and estimating copper at 19 cents and brass at 15.66 cents per pound, with an average differential of 17 cents between raw material and finished goods, the estimated value of the 1920 production of seamless tubes of brass and copper is about $27,000,000. Bronze-tube consumption in the United States is negligible except Admiralty condenser tubes, which may be considered bronze on account of their tin content (1 per cent). But these are ordinarily classed with brass and are made by brass-tube manufacturers. Reports from manufacturers indicate that about one-fifth of the brass tubes used in this country are of the condenser type, and that about one-fourth of these, or about 3 or 4 per cent of the total tube output, are made from the Admiralty mixture.

The annual production of brass wire is more difficult to estimate. According to one manufacturer, from twenty to twenty-five million pounds of wire are made annually in the United States from copper and zinc; from copper, zinc, and tin; and from copper and tin. The differential between raw material and finished wire, owing to the fact that most of the finished brass wire is consumed in small diameters, can be calculated at 12 cents per pound. On the basis of an average mixture of 3 parts copper to 1 of zinc (19-cent copper and 9-cent zinc), the value of the average mixture is 16½ cents per pound, which, added to the arbitrary differential, makes an estimated selling price of wire of 28½ cents per pound and a total sales value of $7,000,000.

The output of sheets in 1920 is about 350,000,000 pounds. Assuming 2 parts of copper to 1 of zinc and price of 19 and 9 cents per pound, respectively, and 12 cents as the average manufacturing differential, the value of the total output is about $100,000,000.

Domestic exports.—The value of the exports of brass products averaged $4,500,000 during the fiscal years 1912 to 1914, inclusive. Canada, Great Britain, Germany, Mexico, and Cuba were the chief consumers, but considerable amounts were exported to all parts of the world. The war demands caused large increases in the export tonnage. Great Britain, France, Canada, and Italy received most of the material. The following table brings out the changes caused by war demand.

Exports of brass and bronze products to France, Great Britain, Canada, and Italy.

(Fiscal years.)

	1914	1917	1918
Canada	$2,790,913	$44,900,380	$17,697,608
France	53,230	84,881,860	11,275,740
Great Britain	636,112	225,653,023	8,077,371
Italy	17,569	13,439,599	13,260,990

The Orient is a large consumer of sheets, but the character of sheets required is slightly different from that ordinarily made in this country, owing to the fact that the more advanced manufactures are not made by machinery in the East but are produced by hand. A cheaper grade of brass was therefore permissible in these markets than is required by American and European manufacturers. The European sheet rollers, however, produced this type

of sheet, and while they can now be made in the United States, American manufacturers have never thought the business worth while going after in view of the low price at which the special sheet was sold by the European mills. During and since the war American sheets, as well as rods and wire, have been sold in the Orient in some quantity, but many manufacturers believe that their recent success in oriental markets is due solely to the fact that European manufacturers have not yet reestablished their industries on a peace basis.

FOREIGN PRODUCTION.

England, France, and Germany have been the chief foreign countries engaged in the manufacture of rolled brass and copper. The production of all these countries has been greatly in excess of their home requirements, and the European establishments under peace conditions must depend to a considerable extent upon exports to maintain their output. In general, raw-material prices in this country do not differ greatly from those in Europe, but wages are much lower.[1] Foreign plants are almost always smaller than those commonly found in the United States, and as a class have been less efficient in operation. This in part is explained by the greater variety and sizes of products produced in the same establishments, but is also due to the fact that the equipment of many foreign mills has been less complete. Even prior to the war, however, English and German manufacturers were studying American methods of production and were gradually adopting modern machinery.[2]

IMPORTS.

Imports are confined for the most part to small lots of special sizes and shapes which domestic manufacturers can not manufacture except at a large advance over the base price. Boiler tubes were imported in some quantity just prior to the war. These were offered at low prices by English manufacturers. There has been practically no importations of brass sheets or wire for many years. A certain amount of articles manufactured from sheet brass have been imported, but the quantities are not large as compared with the American output, and it is not apparent that the importations have been caused by the relative cheapness of brass sheet abroad as distinguished from other causes inherent to the individual products.

The total value of the imports of brass and bronze manufactures increased during the period 1910 to 1914 from $369,900 to $711,000. The imports during 1914 (fiscal year), the first year under the new tariff, showed an increase of almost $200,000 over those entered during 1913.

As a result of the Panama Canal act and the similar provision in the tariff act of 1913, manufactures of brass and bronze to the value of $24,000 and $58,000 were admitted duty free during the fiscal years 1913 and 1914, respectively, for the construction and equipment of vessels. These importations were mainly boiler and condenser tubes and sheet metal, and domestic manufacturers of tubes

[1] See pages 85 to 87, inclusive, for detailed wage comparisons.
[2] See notes regarding other European producers, infra.

complain that since marine *boiler* construction is one of the chief uses for bronze tubes, their free entry will deprive the domestic industry of their chief market for this product.

PRICES.

The usual quotations in brass and bronze plates, tubes, sheets, and wire are base prices covering a narrow range of sizes and gauges under each class of product. A list of extras is furnished which gives additions or deductions from base to cover all variations from base. All of these products are sold by the pound metal content. Quantity-production methods enable the domestic producer to manufacture the base grades very advantageously, but manufacturing special sizes and weights disrupts the organization to some extent, and the extra cost is therefore greater in this country than is the case in European plants where the output of special sizes constitutes a larger percentage of the total output.

In October, 1919, English base prices ranged from 1 to 3 cents per pound lower than American published quotations and their extras averaged considerably lower. On brass strips, for instance, the British base sizes ran down to 0.022-inch thickness on 2 to 6 inch widths, and no extra was charged on metal from 2 to 12 inches wide if the gauge was 0.032 inch or thicker. On strips 8 inches wide and narrower the American extras were low, but as the wider widths were reached they ranged from 10 to 30 cents per pound. The British extras on sheets from 18 to 24 inches wide by 48 inches long and not thinner than 0.022 inch would be about 2 cents per pound or less, as compared with the American 9 to 15 cents, and on sheets 36 by 48 inches by 0.04 inch the British extra would be 4 cents and the American 35 cents.

On brass wire the American extras were also higher, in October, 1919, the difference increasing with the finer sizes. Wire 0.104 inch and thicker is a base size in England, and from that size down to 0.064 inch carried a one-half cent extra as compared with 2 cents on the American product. The British list showed 1½ cents extra for 0.036 inch, whereas the American list was 4½ cents extra above base. The difference was not so great on 0.022 inch, their extra being 5½ cents as compared with our 6 cents. The British extra for spring wire was 1 cent and for pin wire one-half cent. For cutting wire to length the British extra was 1½ cents for base sizes, 3 cents for wire from 0.092 to 0.064 inch, and 7½ cents for wire from 0.056 to 0.036 inch. A rod less than one-fourth inch in diameter is considered straight wire. All the above figures applied to round wire, and on shaped wire there was a corresponding difference.

On seamless tubing there was an individual list for brass and bronze and one for copper, the extras in almost every case being higher for brass than for copper. The English lists showed a wider range in base sizes for copper than for brass, and as compared with the American list were above the American extras for brass and under American extras for copper.

The statistical matter under prices, infra, shows the monthly published quotations for high brass base sheets from 1910 to 1919 and other price data supplied by various correspondents.

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TARIFF HISTORY.

Brass and bronze plates, sheets, pipes, tubes, and other manufactures, with the exception of wire, have been classified as miscellaneous metal manufactures in the tariff acts since 1883. The duties were 45 per cent under the acts of 1883, 1890, 1897, and 1909, 35 per cent in 1894, and 20 per cent under the act of 1913.

Brass and bronze wire were also dutiable under the basket paragraph in the acts of 1883, 1890, 1894, and 1897. In 1897 and 1909 brass and bronze wire remained under the basket paragraph, but certain manufactures of such wire, including electrically insulated wires and cables, were specifically provided for in the paragraph with iron and steel wire at 45 per cent ad valorem. A further provision was made that all manufactures of wire should be dutiable at 1 cent per pound in addition to the ad valorem rate. In 1913 brass and bronze wire and "manufactures of" were grouped with iron and steel wire at 15 per cent ad valorem.

Yellow metal sheet, known as sheathing in the shipbuilding trade, has always been classified with copper sheet, because of the fact that sheet brass was formerly an important competitor of copper for use as sheathing. The present duty on this material is 5 per cent, whereas other sheet is dutiable at 20 per cent under the general basket paragraph.

COMPETITIVE CONDITIONS.

The domestic brass and bronze rolling mill industry has concentrated its attention on standardizing the articles manufactured so as to obtain the maximum benefit from large-scale production. As a result, the standard products can be manufactured here very efficiently, but special sizes result in considerable extra trouble and expense.

Prior to the war, the German industry was progressive and was expanding rapidly at the expense of British trade and to a smaller extent competing with American manufacturers in the United States and abroad. Germany was the largest exporter of brass and bronze products to the United States, and several manufacturers have reported to the Tariff Commission that they could obtain German brass tubes before the war cheaper than those made by American manufacturers. German wages were lower than in the domestic industry, and by organizing large production units and concentrating upon a relatively small number of products German manufacturers obtained the advantages of low labor costs.

The English industry, on the other hand, attempted to make all st les, shapes, and weights of products to suit individual buyers. Large-scale production was the exception, and most of the material was produced in what, according to American standards, would be termed "small mills." Yellow metal sheets (hot rolled) were produced in quantity by the copper smelters in South Wales and large-scale production of boiler and condenser tubes was conducted especially in Yorkshire. In both these classes a large home market existed in the British shipbuilding industry, and a fair amount of foreign trade was successfully conducted in various lines, but the only important English competition in the American market before the war was in tubes, which were increasingly imported into the United States in 1913 and 1914, several British firms having established agencies in country.

The war temporarily eliminated the German industry and stimulated production in France and England. In both these countries the productive capacity was greatly increased so as to materially increase the normal surplus over ordinary domestic requirements in these countries. American methods of production were more widely adopted, especially in England, where the extrusion process was introduced, replacing rolling in the manufacture of many classes of shapes, although extruded rod is not widely used in England for making wire. The most important achievement in the British industry was the elimination of minor lines and a better organization under the manufacturers' association, which resulted in some elimination of competing lines, so that a better degree of standardization of products of the individual plants has been obtained.

Foreign competition in the American market has not assumed large proportions since the war, but this may be in part at least attributed to the fact that the world markets were starved during the war and that, following the cessation of hostilities, English and French brass manufacturers have had more orders than they could fill. The English, however, have begun to catch up on their orders and should within a few months have a surplus that may be sold to new customers.

Japan has been importing large quantities of copper and zinc since the war and is believed to be on the verge of producing brass and copper rolled products on a large scale. Little is known about the plans of the Japanese, but it is reported that considerable equipment suitable for rolling nonferrous metals has been purchased, and under proper management the low-priced labor should result in low-cost product. Some competition is already reported in the Orient from sheets made in that country. During 1919 Japanese manufacturers exported to Canada, the United States, and European countries brass sheets valued at 6,952,000 yen, bars and rods valued at 938,409 yen, and other manufactures valued at 2,550,000 yen. (The Japanese yen is worth about 50 cents at the current rate of exchange.)

British wages in the brass rolling mill industry in 1920 were only a little more than one-half those paid in the United States. Common labor in British plants received a minimum of 63s. 7d. per week of 48 hours, which, at present exchange ($3.50), is equivalent to only 23 cents an hour, as compared with 45 cents or more paid to similar workers in the United States. The wage of rollers, etc., ranged in England about 80 shillings per week, or less than 30 cents per hour, as compared with from 60 to 80 cents in various American mills. Even with the return to normal exchange, assuming no reduction in money wages abroad, the English scale would be only about two-thirds that paid in the United States. Recent reports indicate that the French scale at standard exchange is about 60 cents per hour for skilled workers in the brass trade and from 35 to 45 cents per hour for common and semiskilled labor. In addition to the basic wage there are various allowances, so at standard exchange the French wages are apparently not greatly different from those paid in the United States, although, owing to the depreciation of the franc, they are actually only about one-third of those now being paid in American plants.

An actual wage comparison can not indicate the relative labor cost in production between the various countries, since equipment

and methods are much more important in this industry than in many lines of metal manufacture. An extreme example is the case of one American firm which reports that the production per man in its rod and wire mills increased from 168 pounds in 1913 to 403 pounds in 1920 as a result of the introduction and use of extruded rod. While this is exceptional, it may serve to show that a strict comparison of competitive conditions on the basis of wages is not justifiable. In general, it would seem that American brass rolling mills can hold their own in bulk lines for the American trade but are at some disadvantage in the production of special sizes, and also may expect a resumption of active competition from abroad in tubes which are made on bulk lines in both Germany and England, thereby realizing to a greater extent the advantage of relatively cheap labor than in the case of ordinary sheet, rods, and wire.

TARIFF CONSIDERATIONS.

The brass and bronze manufacturing industry ranks as an extremely important industry in the United States and might well be given mention in a special paragraph similar to that accorded to manufactures of copper. The mention of "sheathing or yellow metal of which copper is the component of chief value, and not composed wholly or in part of iron ungalvanized," in paragraph 147 along with copper manufactures is incongruous. Sheathing is a word most generally used to mean the sheets for covering boat or ship hulls under the water line and may apply to pure copper, bimetal of steel and copper, as well as to the more common yellow brass. Yellow metal sheathing is merely hot rolled brass sheet, but yellow metal includes plates, rods, tubes of various classes, or any other partly or wholly manufactured articles or wares made from hot rolled or extruded brass. There is no apparent reason for distinguishing yellow metal, and especially yellow metal sheathing, from other manufactures of brass in similar stages of manufcture. Such material is admitted at the rate of 5 per cent, whereas other rolled brass products carry a 20 per cent rate.

The American Brass and Copper Statistical Exchange, which comprises manufacturers which produce a large part of the total domestic output of brass and copper products, has prepared resolutions in favor of specific rather than ad valorem rates of duty on these products and has placed itself on record as favoring a procedure that would result in taking American costs as the basis for a duty rather than using foreign selling prices.

The shipbuilding industry is one of the largest consumers of brass and bronze products and the chief consumer of certain tubes and sheet products. The Panama Act and the provisions under the 1913 act for the free entry of material for use in the construction, equipment, or repair of vessels nullifies the nominal protection given to domestic manufacturers on certain products. Since many of the shipyards are on the Atlantic seaboard, material can in many cases be unloaded from ocean-going vessels at the point of consumption without further handling or freight charges, whereas shipment from domestic mills ordinarily involves railroad transportation, which makes a further handicap to the domestic manufacturers in competing for this kind of business.

Distribution of the copper-alloy manufacturing industry among the 10 principal States, 1914.[1]

States.	Number of establishments.	Establishments employing (wage earners)—							
		1-5	6-20	21-50	51-100	101-250	251-500[2]	501-1,000[2]	1,000[2]
Total of United States	992	397	278	114	55	39	14	4	9
Connecticut	67	18	9	13	7	3	6	1	7
Illinois	75	23	30	10	5	2	.....	.....	.....
Indiana	21	5	8	2	.....	2	.....	.....	.....
Massachusets	73	29	29	4	3	2	.....	1	.....
Michigan	64	23	13	6	5	11	3	.....	1
New Jersey	61	27	13	7	5	3	.....	.....	.....
New York	228	97	60	21	12	8	3	1	1
Ohio	84	35	26	10	7	3	2	.....	.....
Pennsylvania	107	45	32	15	6	3	.....	.....	.....
Wisconsin	30	11	9	6	2	.....	.....	1	.....

[1] Census of Manufacturers, 1914.
[2] The rolling and wire mill industry is included in these columns. Smaller establishments are engaged chiefly in other lines of manufacture.

Comparative wages, July, 1914, and Sept. 1, 1920.

[From reports furnished the Tariff Commission by a domestic brass mill.]

	July, 1914.	Sept. 1, 1920.	Percentage of increase.
Mechanical department:			
Engineers	$0.30	$0.710	137
Firemen	.20	.60	200
Sheet-metal workers and tinsmiths	.25	.65	160
Traveling-crane operators	.30	.67	123
Electricians	.325	.77	137
Masons	.35	.173	108
Masons' helpers	.20	.60	200
Carpenters	.29	.60	107
Millwrights	.325	.80	146
Millwrights' helpers	.20	.70	250
Blacksmiths	.325	.68	109
Blacksmiths' helpers	.18	.60	233
Pipe fitters	.35	.775	121
Pipe-fitters' helpers	.20	.61	205
Machinists	.325	.85	162
Die makers, special shapes	.375	.83	121
Casting shop:			
Casters, pit fires	.13	.2125	63½
Helpers, pit fires	.10	.18	80
Operator, electric furnace	.....	[1]1.75	.....
Helpers, electric furnace	.....	[1]1.50	.....
Copper mill:			
Breakdown roller	.30	.878	192
Breakdown roller helper	.16	.729	355
Breakdown rollers' heaters	.20	.729	264
Hot rollers	.35	.993	184
Hot rollers' helpers	.20	.878	339
Hot rollers' heaters	.20	.878	339
Cold rollers	.225	.81	260
Cold rollers' helpers	.16	.673	320
Shearmen	.20	.773	286
Stretcher	.20	.736	268
Polishers	.20	.813	306
Annealers	.20	.718	259
Pickler	.225	.643	180
Packer	.30	.63	110
Brass mill:			
Breakdown rollers	.275	.802	192
Breakdown helpers	.16	.713	346
Rundown rollers	.25	.749	200
Brass mill—Continued.			
Rundown rollers, helpers	$0.16	$0.671	319
Finish rollers	.35	.808	131
Finish stickers	.20	.695	248
Finish blockers	.16	.645	303
Finish helpers	.16	.645	303
Scalpers and overhaulers	.16	.712	345
Shearmen	.325	.669	106
Shearmen helpers	.16	.634	296
Slitters	.325	.669	106
Slitters' helpers	.16	.634	296
Sawmen	.235	.60	155
Sawmen helpers	.16	.55	244
Picklers	.16	.69	331
Annealers	.235	.688	193
Annealers' helpers	.16	.64	300
Truckers	.16	.658	311
Packers	.35	.65	86
Packers' helpers	.16	.55	244
Tube mill:			
Piercer operator	.20	.657	228
Piercer helpers	.16	.608	280
Benchmen	.18	.708	330
Benchmen helpers	.16	.636	297
Pointers	.16	.674	321
Sawmen	.20	.60	200
Sawmen helpers	.16	.55	244
Straighteners	.20	.569	184
Brazers	.30	.776	155
Annealers	.20	.691	245
Packers	.285	.69	144
Brass-wire mill:			
Extruder operator	.50	.90	80
Extruder operators' heaters	.20	.72	260
Benchmen	.18	.658	265
Drawers, coarse	.18	.656	260
Drawers, fine	.20	.656	228
Pointers	.18	.622	245
Sawmen	.20	.55	175
Straighteners	.20	.598	195
Picklers	.16	.677	323
Annealers	.22	.793	260
Packer	.25	.65	160

[1] Per 2,000 pounds.

Brass rolling-mill products.

WAGES PER HOUR.

Occupation.	Index letter of company.							
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Rollers:								
Breaking down	$0.562 to .760	$0.879 to .545	$0.90 to .80	$0.725 to .77	$0.645 to .816	$0.61	$0.975 to 1.15	.....
Finishing	.687 to .792							.....
Heaters	.475 to .594	.545 to .566	.70 to .80	..... .56	..... .600	..... .61	.60 .645	$0.60 .80
Picklers	..... .48	..... .523	.64 to .70	..... .52	..... .503	..... .61	.46 .655	..... .60
Casters	[1]	1.020 to .619	[2]	.....	.760	.....	.75	[3].75 .90
Helpers	.906 to .940		.....	.....	.....	.....	.58	.....
Machinists	.600 to .790	.50 .860	.850	.800	.764	.81	.84 .50	.60 .80
Wire drawers:								
Fine	.53 to .60	.495 to .564	.90 to .65	.....	.639	.57 .74	....	.65 .75
Coarse								
Common	.450	.495	.55	.495	.523	.54	.46	.48 .55

[1] Paid by weight (brass, $0.28 per hundredweight; bronze, $0.36 per hundredweight), out of which they pay helpers.
[2] Paid by weight, $0.2125 per pot.
[3] Premium work.

EFFICIENCY OF WORKERS.

Company.	Output per man-day.		Company.	Output per man-day.	
	1920	1913		1920	1913
	Pounds.	*Pounds.*		*Pounds.*	*Pounds.*
(a)	114	110.5	(d)	119	121
(b) Rolling mills	204.6	[1] 246.8	(e)	[4] 211	189
(b) Rod and wire mills	[2] 403.2	168.3	(h) Brass rods	225	.....
(c)	[3] 142.38	140.7	(h) Tubing	78.138	.....

[1] Decrease due to lower output and light gauges.
[2] Increased efficiency due to use of extruded rod.
[3] Increased efficiency due to better machinery.
[4] More favorable character of product.

DATA PER TON BASED ON HORSEPOWER-HOURS.

Company.	Horse-power-hours per ton.	Rate in cents.	Power cost per ton, 1920.	Company.	Horse-power-hours per ton.	Rate in cents.	Power cost per ton, 1920.
(a)	2.10	0.014	$0.0294	(d)	117	0.019	$2.21
(b) Rolling mills	373.97	[1] .025	9.23	(e)	[2] 320	.010	3.20
(b) Rod wire	143.68	[1] .025	3.58	(f)	415	.0185	7.58
(c)	826.1	.020	16.52	(h) Brass rods	250	.....	.....

[1] Rate in 1914 was $0.01.
[2] Exclusive of casting.

FRENCH WAGES IN BRASS AND COPPER INDUSTRIES.

(All rates per day of 8 hours, working 48-hour week.)

Breaking down, cold rollers	$4.83
Breaking down, cold rollers, helpers	3.86
Breaking down, rollers	4.83
Breaking down, rollers, helpers	3.86
Rolling down, cold rollers	4.44
Rolling down, cold rollers, helpers	3.48
Finisher, cold rollers	5.02
Finisher, cold rollers, helpers	3.67
Finisher, hot rollers	5.02
Finisher, hot rollers, helpers	3.67
Annealers	3.67
Annealers, helpers	3.48
Shears, saws, slitters, D. C. machiners, straighteners, etc.:	
Operators	3.86
Helpers	2.90
Pickle-tub men	3.86
Overhaulers (women)	2.90
Tinners	2.90
Buffers	2.90
Draw bench operators	2.90
Pointer operators	2.90
Braziers	$2.90
Wire drawers, fine	2.90
Bull-block operators	2.90
Machinists:	
First class	4.83
Second class	4.25
Third class	3.86
Tool makers:	
First class	4.83
Second class	4.25
Third class	3.86
Helpers	3.28
Engineers	7.72
Firemen	3.48
Electricians	3.86
Plumbers	4.25
Masons	3.48
Tinsmiths	4.64
Common labor	2.90
Crane operators	3.48
Casters	5.79
Helpers	4.83

(Above sent to Bridgeport Brass Co. by M. Emile Roger, Paris, France.) Figures converted at normal exchange (1 franc = $0.193). In addition there are allowances for families with children under 14 years, amounting to 15 francs ($2.90) for the first, and 30 francs ($5.79) for each of the others per month. There are also allowances given to either man or woman at birth of a child and during confinement of woman workers. Housing facilities are furnished at minimum rentals and food, clothing, etc., are sold at cost prices.

Wages about three times prewar and production only 70 to 75 per cent prewar.

Raw materials and supplies—Domestic materials.

[Comparative prices, July, 1914, and Sept. 1, 1920.]

Article.	Prewar.	September, 1920.	Increase.
			Per cent.
Copper, pound	$0.14	$0.19	36
Spelter, do	.0505	.083	64
Coke, ton	4.50	15.75	250
Boiler coal, do	2.20	10.80	391
Crucibles, each	2.75	8.60	213
Charcoal, ton	9.50	35.00	268
Firebrick (9-inch), M	37.50	68.30	82
Roll oil, gallon	.0885	.215	143
Sulphuric acid, ton	16.00	25.00	56
Tallow, pound	.06⅝	.11¾	77
Cotton waste	.05⅝	.13	142
Polishing compound (Tripoli), pound	.02½	.08	256
Brown wrapping paper, do	.04½	.15½	265
Twine, do	.09½	.65	567
Wire nails (10 d.), keg	1.75	6.70	282
Waterproof paper, roll	1.50	3.00	100
Lumber, M	19.00	51.00	169
Mill and forge castings, pound	.02½	.06	167
Leather belt, 3-inch, foot	.48	.96	100
Kerosene, gallon	.06	.206	243
Gasoline, do	.10⁷	.288	188
Fuel oil, do	.03¼	.11½	254

Manufactures of brass and bronze products, 1914—Production in United States.[a]

[From Federal Census.]

Number of establishments	904
Persons engaged	37,627
Capital	$95,827,707
Salaries and wages	$26,415,962
Cost of materials	$85,130,678
Value of products [b]	$123,580,434
Value added by manufacture	$38,449,756

Brass and bronze manufactures—Production in United States [1]*—Classification of product produced.*

[From Federal Census.]

	Value of products.		
	Brass and bronze.	Copper.	Other.
Ingots and bars	$7,460,396	$1,357,804	$1,375
Plates and sheets	25,928,193	13,638,770	3,453,034
Rods	8,277,388	6,220,067	72,304
Tubing	10,131,975	3,613,370	189,296
Seamless	6,967,813	3,119,458	186,484
Brazed	3,164,162	493,912	2,812
Wire	5,851,670	52,940,097	1,277,971
Plain	5,851,670	[2] 37,230,815	1,277,971
Insulated		15,709,282	
Other manufactured products	73,854,102	5,071,138	[3] 6,281,195
All other			[4] 5,642,613
Total	131,503,724	82,841,246	16,917,784

[1] Census Manufactures, 1914.
[2] Includes $13,966,315 estimated value of 23,458 tons manufactured and consumed in establishments manufacturing electrical machinery.
[3] Includes aluminum castings to value of $6,101,198.
[4] Includes amounts received for custom work and value of some products made from metals other than brass, bronze, copper, German silver, or aluminum.

Distribution of imports of brass and bronze manufactures (fiscal years).

	1910	1911	1912	1913	1914	1915
Brass wire	$239	$1,725	$1,914	$2,725	$5,103	$4,177
Brass wire, manufactures of	6,597	8,848	14,681	52,250	26,175	8,639
Brass, all other manufactures of	138,707	203,026	333,884	280,750	486,579	588,897
Bronze wire	(1)	(1)	(1)	(1)	10,523	94
Bronze wire, manufactures of	(2)	(2)	(2)	28,211	85,194	31,414
Bronze, all other	224,362	221,817	236,407	165,410	96,637	44,456
Total	369,905	435,416	586,886	529,346	710,211	677,677
Duty remitted			300	24,420	58,637	13,765

	1916	1917	1918	1918[3]	1919[3]	1920[3]
Brass wire	$636	$2,214	$2,880	$3,087	$32	$2,283
Brass wire, manufactures of	7,162	12,005	4,433	9,427	12,676	6,308
Brass, all other manufactures of	187,166	398,863	239,584	236,025	252,978	322,492
Bronze wire			1,080			595
Bronze wire, manufactures of	1,092	2,975	2,533	5,977	33,094	40,406
Bronze, all other	76,923	177,277	196,660	122,472	167,866	295,511
Total	272,979	593,334	447,170	376,988	466,646	667,595
Duty remitted	8,085	17,937	45,158	101,726	305,236	51,010

[1] Included in bronze, all other manufactures of, prior to Oct. 3, 1913.
[2] Included in bronze, all other manufactures of, prior to 1913.
[3] Calendar year.
[a] Census of Manufacturers 1914.
[b] In addition brass and bronze products valued at $7,923,299 were manufactured in plants engaged primarily in other industries.

Brass, manufactures of—Imports by countries (calendar years).

Imported from—	1918.[1]	1919
France	$8,763	$65,752
Germany	15	674
Netherlands	2,146	3,282
Switzerland	16,228	18,959
United Kingdom	41,881	108,076
Canada	89,567	51,583
Japan	10,119	25,409
All other	1,426	24,870
Total	170,145	298,604

[1] July 1 to Dec. 31, 1918.

Bronze, manufactures of—Imports by countries (fiscal years).

Imported from—	1910	1911	1912	1913	1914	1915
Austria-Hungary	$7,765	$8,881	$7,840	$9,556	$4,936	$1,338
Belgium	416	1,030	614	786	836	.....
France	161,003	153,447	153,531	126,412	54,747	24,650
Germany	640,763	564,110	521,805	605,649	588,173	401,689
Italy	18,134	17,388	24,831	18,995	10,023	6,796
United Kingdom	21,903	8,282	10,283	9,177	15,578	8,660
Canada	1,460	1,015	1,724	239	533	4,003
Japan	4,616	9,684	12,710	4,217	6,108	5,850
All other	832	1,983	3,636	3,838	1,149	3,190
Total	856,892	765,820	736,974	778,869	682,083	456,176

Imported from—	1916	1917	1918	1918[1]	1919[1]
Austria-Hungary	.....	.....	.....	.....	$2,265
Belgium	$8	.....	.....	.....	1,659
France	21,320	$35,619	$24,244	$17,412	81,649
Germany	32,519	2,940	.....	.....	38,402
Italy	8,141	8,904	3,238	1,411	10,054
United Kingdom	9,577	11,445	1,583	4,330	29,696
Canada	68,643	29,440	18,696	15,007	2,971
Japan	54,968	463,949	367,043	259,102	80,923
All other	8,180	10,431	6,934	1,243	5,730
Total	203,356	562,728	421,738	298,505	253,349

[1] Calendar years

Brass, and manufactures of—Wire, manufactures of—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1908	1½ cents per pound and 45 per cent.	32,907.00	$25,276.00	$11,785.00	$0.768	46.63
1909	....do....	24,950.40	24,298.66	11,246.28	.974	46.28
1910[1]	....do....	1,271.00	1,283.00	593.25	1.010	46.24
1910[2]	1 cent per pound and 35 per cent.	255.00	289.00	103.70	1.130	35.88
1911	....do....	407.00	48	20.87	.118	43.48
1912	....do....	485.00	57	24.80	.118	43.51
1913[3]	1 cent per pound and 45 per cent.	81,410.65	52,250.20	24,326.71	.642	46.56
1914[3][4]	....do....	20,186.00	12,997.00	6,050.51	.644	46.55
1914[5]	15 per cent	.....	13,178.00	1,976.70	.....	15.00
1915	....do....	.....	8,639.00	1,295.85	.....	15.00
1916	....do....	.....	7,162.00	1,074.30	.....	15.00
1917	....do....	.....	12,005.00	1,800.75	.....	15.00
1918	....do....	.....	4,433.00	664.95	.....	15.00
1918[6]	....do....	.....	9,427.00	1,414.05	.....	15.00
1919[6]	....do....	.....	12,676.00	1,901.40	.....	15.00
1920[6]	....do....	.....	6,308.00	946.20	.....	15.00

[1] July 1 to Aug. 5, 1909, under act of 1897.
[2] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[3] Treasury decision 32600.
[4] July 1 to Oct. 3, 1913, under act of 1909.
[5] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[6] Calendar year.

Brass, and manufactures of—Wire and manufactures of—Other on which ordinary duty does not amount to 40 per cent—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1910 [1]	40 per cent	5,546.00	$5,025.38	$2,010.15	$0.906	40
1911	do	12,951.71	8,799.97	3,519.99	.679	40
1912	do	20,333.50	14,624.00	5,849.60	.719	40

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.

Brass, and manufactures of—Wire, and manufactures of—Wire—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1910 [1]	35 per cent	609	$239.00	$83.65	$0.392	35
1911	do	6,223	1,725.00	603.75	.277	35
1912	do	6,416	1,914.00	669.90	.298	35
1913 [2]	45 per cent	8,279	2,725.50	1,226.48	.329	45
1914 [2 3]	do	103	41.00	18.45	.398	45
1914 [4]	15 per cent		5,062.00	759.30		15
1915	do		4,177.00	626.55		15
1916	do		636.00	95.40		15
1917	do		2,214.00	332.10		15
1918	do		2,880.00	432.00		15
1918 [5]	do		3,087.00	463.05		15
1919 [5]	do	102	32.00	4.80	.314	15
1920 [5]	do	4,010	2,283.00	342.45	.569	15

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[2] Treasury Decision 32600.
[3] July 1 to Oct. 3, 1913, under act of 1909.
[4] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[5] Calendar year.

Brass, and manufactures of—All other manufactures of (n. s. p. f.)—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
						Per cent.
1908	45 per cent		$147,807.00	$66,513.00		45
1909	do		112,782.96	50,752.33		45
1909 [1]	75 per cent of 45 per cent.		3.00	1.01		33.75
1910	45 per cent		138,677.47	62,404.87		45
1910 [1]	Free		30.00			
1911	45 per cent		202,587.50	91,164.37		45
1911 [1]	Free		439.00			
1912	45 per cent		333,730.36	150,178.72		45
1912 [1]	Free		114.00			
1912 [2]	45 per cent less 20 per cent.		40.00	14.40		36
1913	45 per cent		280,634.44	126,285.54		45
1913 [1]	Free		1.00			
1913 [2]	45 per cent less 20 per cent.		115.00	41.40		36

[1] From Philippine Islands. [2] Reciprocity treaty with Cuba.

Brass, and manufactures of—All other manufactures of—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal years:						*Per cent.*
1914 [1]	45 per cent		$71,966.87	$32,385.09		45
1914 [2]	20 per cent		414,460.73	82,892.14		20
1914 [2 3]	20 per cent less 20 per cent.		20.00	3.20		16
1914 [4]	Free		131.00			
1915	20 per cent		588,742.00	117,748.40		20
1915 [3]	20 per cent less 20 per cent.		20.00	3.20		16
1915 [4]	Free		135.00			
1916	20 per cent		187,160.00	37,432.00		20
1916 [4]	Free		6.00			
1917	20 per cent		398,611.00	79,722.20		20
1917 [3]	20 per cent less 20 per cent.		15.00	2.40		16
1917 [4]	Free		237.00			
1918	20 per cent		239,546.00	47,909.20		20
1918 [3]	20 per cent less 20 per cent.		11.00	1.76		16
1918 [4]	Free		27.00			
Calendar years:						
1918	20 per cent		235,993.00	47,198.60		20
1918 [3]	20 per cent less 20 per cent.		11.00	1.76		16
1918 [4]	Free		21.00			
1919	20 per cent		252,477.00	50,495.40		20
1919 [4]	Free		501.00			
1920	20 per cent		322,438.00	64,487.60		20
1920 [4]	Free		54.00			

[1] July 1 to Oct. 3, 1913, under act of 1909.
[2] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[3] Reciprocity treaty with Cuba.
[4] From Philippine Islands.

Brass, and manufactures of—Wire, manufactures of (duty remitted)—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
						Per cent.
1914 [1]	Sec. IV, J5		$10,778			
1915 [1]	do		10,230			
1918 [1 2]	do		1,821			
1919 [1 2]	do		745			
1920 [1 2]	do		1,477			

[1] For construction and equipment of vessels.
[2] Calendar year.

Brass, and manufactures of—All other manufactures of (duty remitted)—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal years:						*Per cent.*
1912	Sec. 19, act of Aug. 5, 1909.		$300.00			
1913	do		9.00			
1913	Panama act, act of Aug. 24, 1912.		23,900.00			
1914 [1]	Sec. IV, J5, act of Oct. 3, 1913.		46,486.00			
1914	For use of the United States.		1,173.00			
1915 [1]	Sec. IV, J5, act of Oct. 3, 1913.		3,535.00			
1916 [1]	do		2,967.00			
1917 [1]	do		11,242.00			
1918 [1]	do		15,892.00			
1918	For use of the United States.		28,426.00			
Calendar years:						
1918 [1]	Sec. IV, J5, act of Oct. 3, 1913.		94,269.00			
1918 [2]	Sec. IV, K, act of Oct. 3, 1913.		5,636.00			
1919 [2]	do		12,931.00			
1919 [1]	Sec. IV, J5, act of Oct. 3, 1913.		174,348.00			
1919 [3]	Sec. IV, J6, act of Oct. 3, 1913.		65.00			
1919	For use of the United States.		117,147.00			
1920	Sec. IV, K, act of Oct. 3, 1913.		1,391.00			
1920	Sec. IV, J5		43,796.00			

[1] For the construction and equipment of vessels.
[2] For supplies of vessels.
[3] For the repair of vessels.

Bronze, manufactures of, not specially provided for—Wire, and manufactures of—Wire imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1914 [1]	15 per cent		$10,523.00	$1,578.45		15
1915	do		94.00	14.10		15
1916						
1917						
1918	15 per cent		1,080.00	162.00		15
1920 [2]	do	404	595.00	89.20		15

[1] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[2] Calendar year.

Bronze, manufactures of, not specifically provided for.—Wire and manufactures of—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1913 [1]	1 cent per pound and 45 per cent.	60,233	$28,211.00	$13,297.28	$0.468	47.14
1914 [1 2]	do	46,974	20,942.00	9,893.64	.446	47.24
1914 [3]	15 per cent		64,252.00	9,637.80		15.00
1915	do		31,414.00	4,712.10		15.00
1916	do		1,092.00	163.80		15.00
1917	do		2,975.00	446.25		15.00
1918	do		2,533.00	379.95		15.00
1918 [4]	do		5,977.00	896.55		15.00
1919 [4]	do		33,094.00	4,964.10		15.00
1920 [4]	do		40,406.00	6,060.90		15.00

[1] Treasury Decision 32,600.
[2] July 1 to Oct. 3, 1913, under act of 1909.
[3] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[4] Calendar year.

Bronze, manufactures of, not elsewhere specified (not otherwise provided for)—All other—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
						Per cent.
1908	45 per cent		$387,734.00	$174,480.00		45
1909	do		195,150.14	87,817.58		45
1910	do		224,361.85	100,962.83		45
1911	do		221,816.84	99,817.67		45
1912	do		236,406.54	106,382.95		45
1913	do		165,410.50	74,434.73		45
1914 [1]	do		26,188.05	11,784.62		45
1914 [2]	20 per cent		70,448.50	14,089.70		20
1915	do		44,456.00	8,891.20		20
1916	do		76,893.00	15,378.60		20
1916 [3]	Free		30.00			
1917	20 per cent		177,217.00	35,443.40		20
1917 [4]	20 per cent less 20 per cent.		60.00	9.60		16
1918	20 per cent		196,660.00	39,332.00		20
1918 [5]	do		122,472.00	24,494.40		20
1919 [5]	do		167,866.00	33,573.20		20
1920 [5]	do		295,211.00	59,042.20		20
1920 [5 4]	20 per cent less 20 per cent.		300.00	48.00		16

[1] July 1 to Oct. 3, 1913, under act of 1909.
[2] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[3] From Philippine Islands.
[4] Reciprocity treaty with Cuba.
[5] Calendar year.

Bronze, manufactures of—Wire and manufactures of wire (duty remitted)—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
1918	For use of the United States.		$340			

Bronze, manufactures of—All other (duty remitted)—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
1913 [1]	Sec. 19, act of Aug. 5, 1919.		$511			
1914 [1]	Sec. IV, J5, act of Oct. 3, 1913.		200			
1916 [1]	do		5,118			
1917 [1]	do		6,695			
1920 [1 2]	do		4,346			

[1] For construction and equipment of vessels. [2] Calendar year.

Brass—Bars, plates, sheets, etc.[1]*—Domestic exports.*

FISCAL YEARS.

Exported to—	1912		1913		1914	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Germany	102,462	$14,001	250,950	$38,992	301,046	$34,940
United Kingdom	384,248	41,009	32,931	4,703	122,305	17,017
Canada	5,007,163	722,014	7,071,838	1,128,289	4,964,270	724,253
Italy	2,728	358				
Netherlands	3,000	430	6,788	1,780		
Brazil	438	51	5,064	994	1,432	209
Denmark			484	130		
All other	16,343	2,667	12,689	2,738	76,671	15,210
Total	5,516,382	780,530	7,380,744	1,177,626	5,465,724	791,629

Exported to—	1915		1916		1917	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
France	14,188,112	$1,852,297	27,363,960	$6,849,466	173,722,362	$56,371,757
United Kingdom	13,535,219	2,123,912	48,907,941	13,497,962	116,811,058	32,011,181
Canada	12,122,719	2,096,053	50,570,006	13,459,808	76,463,462	23,498,146
Italy			2,807,278	787,671	14,521,835	5,387,118
Netherlands	163,898	28,689	1,950,943	633,420	3,109,021	1,087,086
Russia in Europe	28,500	5,000	32,981	8,431	6,321,304	2,104,271
Brazil			25,636	7,768	125,091	54,495
Denmark	54,880	8,376	233,956	73,119	235,766	88,169
All other	188,845	34,856	1,213,496	351,954	2,183,116	765,796
Total	40,282,173	6,149,183	133,106,197	35,669,599	393,493,015	121,368,019

[1] Not separately stated prior to 1912.

Brass—Bars, plates, sheets, etc.—Domestic exports—Continued.

FISCAL YEARS—Continued.

Exported to—	1918	
	Pounds.	Value.
France	25,970,727	$8,582,833
United Kingdom	18,161,068	4,533,013
Canada	21,554,242	5,954,566
Italy	19,186,071	7,067,173
Netherlands	3,682,808	1,407,492
Russia in Europe	3,331,820	1,263,605
Brazil	515,001	185,832
Denmark	89,299	40,400
All other	1,050,116	405,669
Total	93,541,147	29,440,583

CALENDAR YEARS.

Exported to—	1918		1919	
	Pounds.	Value.	Pounds.	Value.
France	10,174,925	$3,008,328	604,380	$204,096
Germany			605	120
United Kingdom	629,235	156,586	56,101	21,230
Canada	3,704,961	914,089	2,604,631	664,693
Italy	15,505,271	5,089,846	1,454,154	389,684
Netherlands			477,729	153,625
Brazil	304,236	109,880	801,264	231,407
Denmark	20,196	7,349	673,759	262,836
All other	650,893	236,856	1,098,048	382,870
Total	30,989,717	9,522,934	7,770,671	2,310,561

Brass—All other manufactures of[1]*—Articles made from*[1]*—Domestic exports (fiscal years).*

Exported to—	1912	1913	1914	1915	1916	1917
Belgium	$38,793	$21,044	$26,713	$3,409		
France	56,045	58,196	53,230	2,176,258	$13,585,518	$28,510,103
Germany	201,315	156,254	132,078	7,597		
Netherlands	33,600	35,844	26,137	147,685	1,569,069	314,178
United Kingdom	650,084	641,459	619,095	5,737,984	95,351,540	193,641,842
Canada	2,443,651	3,211,018	2,066,660	3,227,559	12,773,842	21,402,234
Panama	43,580	32,501	52,890	53,087	91,472	191,561
Mexico	229,959	201,455	115,716	66,756	82,094	202,161
Cuba	201,671	274,408	265,415	249,745	386,998	579,632
Argentina	42,319	59,488	42,847	64,023	295,094	216,525
Brazil	28,614	13,485	17,404	60,431	92,133	223,721
Chile	21,499	30,737	31,207	25,510	59,673	188,909
Japan	16,589	19,106	10,492	16,287	29,488	119,644
Australia and Tasmania	128,296	119,489	114,473	139,097	215,802	215,441
New Zealand	17,146	21,585	17,470	45,034	51,955	60,343
Philippine Islands	73,675	67,831	73,035	47,611	52,784	50,712
Italy	17,903	7,350	17,569	54,317	2,358,203	8,052,481
Russia in Europe	17,185	23,728	35,542	4,166	191,247	3,690,779
All other	186,419	224,227	248,672	692,817	1,144,908	2,319,981
Total	4,448,343	5,219,205	3,966,645	12,819,373	128,331,820	259,980,247

[1] Not separately stated prior to 1912.

Brass—All other manufactures of—Domestic exports.

Exported to—	Fiscal year 1918.	Calendar years.		Exported to—	Fiscal year 1918.	Calendar years.	
		1918	1919			1918	1919
Belgium		$318	$35,304	Argentina	$294,432	$224,619	$165,559
France	$2,692,907	2,224,367	244,371	Brazil	351,842	255,761	465,636
Germany			25	Chile	210,235	255,813	172,523
Italy	5,790,607	3,783,058	117,737	Japan	232,056	341,795	142,914
Netherlands	21,101		567,490	Australia	186,199	238,225	272,372
Russia in Europe	372,232		9,443	New Zealand	25,577	41,815	106,853
United Kingdom	1,473,474	473,198	918,261	Philippine Islands	63,248	69,144	168,169
Canada	11,195,199	7,129,738	2,858,414	All other	1,205,219	1,039,160	1,747,483
Panama	134,665	82,582	84,470				
Mexico	240,956	250,230	375,958	Total	25,077,892	17,071,694	9,438,554
Cuba	587,913	661,871	685,572				

Brass—Wire [1]—Domestic exports (fiscal years).

Exported to—	1918	
	Pounds.	Value.
France	360,939	$140,630
Russia in Europe	139,362	60,219
Switzerland	30,493	11,908
United Kingdom	1,225,639	491,241
Canada	466,419	191,969
Cuba	64,583	26,316
Argentina	54,531	21,032
Brazil	178,385	68,240
British India	232,086	83,523
Australia	143,683	60,941
British South Africa	33,023	15,800
Spain	11,271	7,180
Italy	14,394	7,060
Netherlands	6,884	2,809
Norway	10,878	5,564
All other	77,185	36,413
Total	3,049,755	1,230,845

[1] Included in "All other manufactures of" prior to 1918.

Brass—Wire—Domestic exports (calendar years).

Exported to—	1918		1919	
	Pounds.	Value.	Pounds.	Value.
France	207,044	$79,619	31,661	$9,766
Switzerland	13	3	70,521	27,745
United Kingdom	684,356	283,147	178,267	52,748
Canada	374,668	153,794	266,242	98,683
Cuba	52,157	19,948	53,539	17,977
Argentina	50,129	18,617	21,803	6,527
Brazil	130,453	49,144	149,514	48,986
British India	175	112	840	346
Australia	30,513	13,362	19,701	9,210
British South Africa	15,218	6,112	34,776	12,933 [a]
Spain	93,810	32,408	8,104	6,463
Italy	13,894	6,835	422	306
Denmark	2,204	700	53,976	20,953
Netherlands			63,041	19,628
Norway	12,000	6,900	70,826	34,611
All other	82,249	36,581	92,675	37,017
Total	1,748,883	707,287	1,115,908	403,899

Brass—Pipes and fittings [1]*—Domestic exports.*

Exported to—	Fiscal year 1918.	Calendar years.		Exported to—	Fiscal year 1918.	Calendar years.	
		1918	1919			1918	1919
France	$117,391	$42,609	$29,533	China	$42,654	$22,823	$28,332
Italy	28,047	61,175	4,807	Hongkong	27,208	33,676	10,274
United Kingdom	15,314	20,598	28,827	Japan	18,874	15,627	1,586
Canada	303,916	442,177	354,754	Australia	12,768	19,322	22,768
Mexico	20,711	34,894	71,446	Philippine Islands	17,046	31,315	65,014
Cuba	58,054	98,519	107,414	Netherlands			89,087
Argentina	16,416	28,433	126,359	All other	67,958	181,031	360,468
Brazil	10,826	13,966	53,976				
Chile	48,085	91,171	59,230	Total	805,268	1,137,336	1,413,875

[1] Included in "All other manufactures of" prior to 1918.

Brass—Cartridge shells, empty [1]*—Domestic exports.*

Exported to—	Fiscal year 1918.	Calendar years.	
		1918	1919
France	$2,537,878	$90,225	$833
Italy	368,103	335,607	13,100
United Kingdom	829,931	43,598	97,535
Spain	81,910	28,000	2,540
Canada	51,958	3,690	1,268
Australia	30,842	13,349	12,495
All other	76,099	52,360	42,190
Total	3,976,721	566,829	169,961

[1] Included in "All other manufactures of" prior to 1918.

Metals, metal composition, n. e. s.—Bronze, manufactures of [1]*—Domestic exports (fiscal years).*

Exported to—	1915	1916	1917	1918
Belgium	$549			
France	4,627	$30,302	$125,649	$153,429
Germany	350			
Greece	12,144	2,123	700	
Italy	1,189	37,546	33,129	43,136
Norway	5,990	12,206	13,849	6,238
Portugal		360	824	9,516
Spain	2,879	8,867	102,888	18,467
United Kingdom	186,598	444,090	434,862	163,901
Canada	11,476	181,487	332,505	339,762
Mexico	4,675	10,141	20,277	33,187
Cuba	18,512	32,119	112,381	71,585
Argentina	1,548	11,038	22,009	28,907
Brazil	2,947	21,447	64,447	43,842
Chile	3,062	7,798	13,456	25,792
Dutch East Indies	887	30,978	114,563	12,901
New Zealand	2,303	19,839	3,115	1,815
All other	73,853	200,645	191,899	174,290
Total	333,589	1,050,986	1,586,553	1,126,768

[1] Included in "All other articles" prior to 1915.

Metals, metal composition, n. e. s.—Bronze, manufactures of—Domestic exports (calendar years).

Exported to—	1918	1919	Exported to—	1918	1919
Belgium	$31,760	$34,794	Cuba	$74,805	$106,116
France	206,133	147,064	Argentina	29,099	37,893
Greece	30,000	29,905	Brazil	48,842	45,340
Italy	29,573	9,841	Chile	34,071	7,548
Norway	16,627	40,265	Dutch East Indies	31,655	29,565
Portugal	18,607	2,067	New Zealand	42,916	5,984
Spain	33,773	20,746	All other	155,358	455,754
United Kingdom	86,029	86,681			
Canada	350,729	393,664	Total	1,267,032	1,508,086
Mexico	47,055	54,859			

Bronze, manufactures of—Exports of foreign merchandise (fiscal years).

Exported to—	1910	1914	1915	Exported to—	1910	1914	1915
France	$52,000		$1,329	Japan	$350		
Italy			24	Costa Rica		$17	
Canada	806	$2,021	772	Nicaragua		1,000	
Mexico	20		375				
Cuba		30	70	Total	53,176	4,401	$2,570
Germany		1,333					

Exported to—	1916	1918 [1]	1919 [1]	Exported to—	1916	1918 [1]	1919 [1]
France	$1,250			Japan			$9,425
Canada	92	$448	$251	Venezuela	$300		
Mexico	91			Philippine Islands	14		
Cuba	2,412	3,271	841				
Guatemala			21	Total	4,301	$3,719	10,538
Brazil	142						

[1] Calendar years.

High sheet brass—Prices base per 100 pounds prevailing on the 1st of each month.

[From Metal Statistics.]

	1910	1911	1912	1913	1914	1915	1916
January	$14.00	$13.50	$14.37½	$17.12½	$14.75	$13.75	$28.25
February	14.00	13.00	14.75	16.25	14.75	15.50	32.25
March	14.00	13.00	14.50	15.12½	14.50	16.00	34.25
April	14.00	13.00	15.50	15.12½	14.25	17.12½	34.75
May	13.25	13.00	15.75	15.37½	14.25	20.50	35.75
June	13.25	12.75	16.25	15.37½	14.25	[1] 24.25	[1] 36.75
July	13.00	13.12½	16.25	14.75	13.87½	[1] 25.37½	[1] 36.75
August	13.00	13.12½	17.00	14.75	13.50	[1] 26.25	[1] 36.75
September	13.00	13.12½	17.00	15.37½	13.12½	[1] 26.25	[1] 36.75
October	13.00	13.12½	17.37½	16.00	12.75	[1] 26.25	[1] 36.75
November	13.00	13.12½	17.37½	16.00	12.25	[1] 26.25	[1] 36.75
December	13.25	13.62½	17.37½	14.75	13.25	[1] 26.25	[1] 38.50
Average	13.39 7/12	13.12½	16.12½	15.50	13.79⅛	21.97 1/12	35.35 A/12

[1] Market nominal.

High sheet brass—Prices base per 100 pounds.

[From Metal Statistics.]

	1917	1918	1919	1920		1917	1918	1919	1920
January..	$38.50	$26.75	$24.75	$24.25	August....	$33.25	$28.75	$27.75	$25.25
February	38.50	26.75	23.75	25.25	September	31.25	28.75	27.75	25.25
March ...	38.50	26.75	19.25	25.25	October...	31.25	29.25	27.75	25.25
April	36.50	26.75	18.75	25.25	November	30.25	30.00	26.75	22.25
May.....	35.25	26.75	18.75	25.25	December	28.75	30.00	24.25	20.25
June.....	33.25	26.75	19.75	25.25					
July.....	33.25	28.25	22.75	25.25	Average	34.04⅛	27.95⅝	23.50	24.50

Brass and copper—Prices, comparative, July, 1914, and Sept. 1, 1920.

[From reports of companies to United States Tariff Commission.]

[Cents per pound.]

Kinds or grades.	Prewar.	Differential.[1]	Sept. 1, 1920.	Differential.[1]	Percentage increase.
Sheet brass	13⅞	3.455	25½	10.13	82
Brass wire	13¾	3.205	25½	10.63	88
Copper wire	15½	1.25	23	4	50
Brass rod	13⅜	3.205	23⅛	8.63	74
Sheet copper	19	5	29⅝	10.5	55
Roll copper	17	3	27¾	8.75	63
Brazed tubing	18⅜	7.955	38	22.88	52
Seamless tubing, brass	16	5.58	30½	15.38	84
Seamless tubing, copper	19½	5.5	32	13	64
Copper	14	.....	19	.....	36
Zinc	5.05	.....	8.30	.....	64

[1] Take brass as 60/40—value in 1914 was 10.42 cents and in 1920, 15.12 cents. 0.60×14=8.40+0.40×5.05=2.02=10.42 cents, 0.60×19=11.40+0.40×8.30=3.72=15.12 cents.

Brass rolling-mill products—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883	194	Sheathing, or yellow metal, * * * ungalvanized, in sheets, 48 inches long and 14 inches wide, and weighing from 14 to 34 ounces per square foot.	35 per cent ad valorem.
1883	216	Manufactures, articles, or wares, not specially enumerated or provided for in this act, composed wholly or in part of * * * any other metal, and whether partly or wholly manufactured.	45 per cent ad valorem.
1890	195	* * * sheathing or yellow metal of which copper is the component of chief value.	35 per cent ad valorem.
1890	215	Manufactures, articles, or wares, not specially enumerated or provided for in this act, composed wholly or in part of * * * any other metal, and whether partly or wholly manufactured.	45 per cent ad valorem.
1894	161	* * * sheathing or yellow metal of which copper is the component material of chief value.	20 per cent ad valorem.
1894	177	Manufactured articles or wares, not specially provided for in this act, composed wholly or in part of any metal, and whether partly or wholly manufactured.	35 per cent ad valorem.
1897	137	* * * *Provided*, That articles manufactured from * * * brass * * * wire, shall pay the rate of duty imposed upon the wire used in the manufacture of such articles, and in addition thereto 1¼ cents per pound.	
1897	176	* * * sheathing or yellow metal of which copper is the component material of chief value.	2 cents per pound.
1897	193	Articles or wares not specially provided for in this act, composed wholly or in part of * * * or other metal, and whether partly or wholly manufactured.	45 per cent ad valorem.
1909	135	* * * *And provided further*, That no article made from or composed of wire shall pay a less rate of duty than 40 per cent ad valorem; telegraph, telephone, and other wires and cables composed of metal and rubber, or of metal, rubber, and other materials.	40 per cent ad valorem.
1909	176	* * * sheathing or yellow metal of which copper is the component material of chief value.	2 cents per pound.
1909	199	Articles or wares not specially provided for in this section, composed wholly or in part of * * * or other metal, and whether partly or wholly manufactured.	45 per cent ad valorem.
1913	114	* * * all other wire not specially provided for in this section and articles manufactured wholly or in chief value of any wire or wires provided for in this section; all the foregoing.	15 per cent ad valorem.
1913	147	* * * sheathing or yellow metal of which copper is the component material of chief value.	5 per cent ad valorem.
1913	167	Articles or wares not specially provided for in this section; * * * if composed wholly or in chief value of * * * brass, * * * or other metal, but not plated with gold or silver, and whether partly or wholly manufactured.	20 per cent ad valorem.

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